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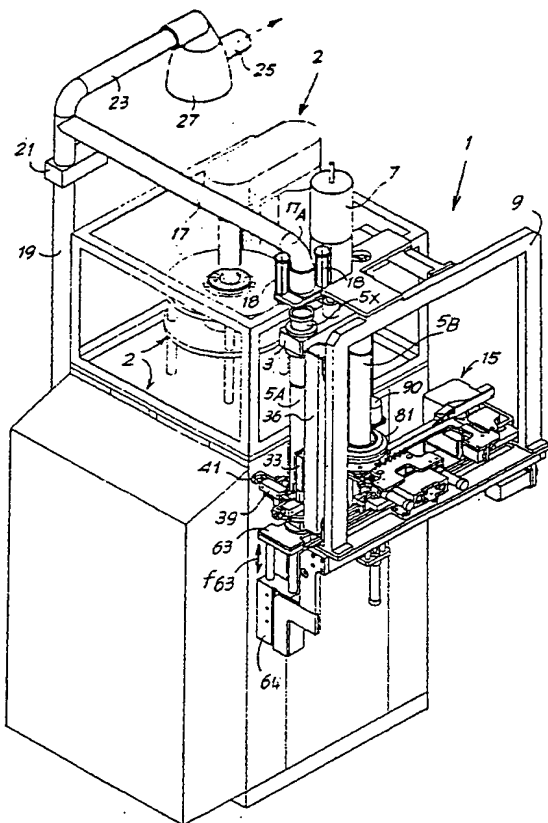
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(54) Title: DEVICE FOR TRANSFERRING A TUBULAR KNITTED ARTICLE FROM THE MACHINE WHERE IT IS MADE TO MEANS FOR CLOSING THE TOE



(57) Abstract: The device comprises the following combination: a support (3) with a first tubular member (5A) and a second tubular member (5B) each of which can be alternatively positioned in a first and a second station; a pneumatic transfer tube (17) which can be interfaced with the knitting machine (2) where the article is made, to transfer the articles to be closed from said machine to said first station; in the first station, positioning members for positioning said article on said first and second tubular member in said first station; in the second station, means for tensioning the toe of the tubular article and closing means for closing the toe; a pneumatic conduit (17) 23) for unloading the article after closing the toe.

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"Device for transferring a tubular knitted article from the machine where it is made to means for closing the toe"

DESCRIPTION

Field of the invention

5 The present invention relates to a device for transferring tubular articles, e.g. tubular knitted articles, such as stockings or socks and the like, from a knitting machine where they are made, e.g. a circular knitting machine, to means (which are external to the knitting machine) which close the toe of the articles.

10 The invention also relates to a method for making tubular knitted articles with closed toe and a knitting machine equipped with a device of this kind.

State of the art

15 One of the most critical aspects in the production of socks, stockings and other tubular knitted articles is represented by the need to sew or linking the end edges of the article to form the closed toe of the article itself. Normally, this operation is carried out off the knitting machine in a separate department using specific machines with large deployment of labor.

20 Attempts have been made to overcome such problems and automate the production of socks and other similar knitted tubular products, whereby reducing the space needed for the respective machines.

25 Knitting machines which include particular devices for closing the toe during either a final phase or an initial phase of the knitting process of the article have been designed for this purpose. This approach causes construction problems and cannot be implemented in traditional knitting machines because they cannot be transformed to comprises such devices.

30 WO-A-00/011869 describes a device and a procedure for closing the toe of a tubular article by sewing which consists in arranging a sewing machine under the needle cylinder of the knitting machine. The tubular article is gripped by retaining means before being fully released from the needles of the knitting machine and transferred to the sewing machine underneath by means of an intermediate system for turning it inside out. After being sewn,

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the article is turned inside out again and removed from the machine. This device and this method present the problem of once again requiring an internal modification of the knitting machine in order to be implemented. Such an intervention is not always possible and implementation depends, among
5 other things, on the dimensions of the machine members and the available space under the needle cylinder, as well as the longitudinal dimension of the articles to be made.

EP-A-1118700 describes a device with a system for extracting the article from the knitting machine by means of a tubular guide which is inserted
10 coaxially with respect to the needle cylinder inside and around which the tubular article is formed. The extracted article is then transferred to a system for closing the toe external to the knitting machine and arranged, for example, by the side of it. This system has the advantage, with respect to the previous one, of being more easily implemented in knitting machine of the existing
15 type. However, this solution also presents limitations. This is because a considerable axial dimension of the knitting machine is required for implementing the adaptation.

Normally, knitting machines - specifically those use for making socks, stockings and pantyhose legs - implement a pneumatic system for extracting
20 the article from the knitting machine by means of a tube inside which the product is sucked when it is released by the needles. The tubular articles with open toe are then collected in containers in which they are transferred to specific departments where the toes are sewn and other operations are carried out, e.g. in the case of pantyhoses, the two legs (separately made by
25 the knitting machine) are coupled to form a single finished garment. Very complex and costly machines working at extremely high production rates are used to carry out these operations. Each machine receives the tubular articles from a container from the production department, made using several different circular knitting machines. Each machine consists in various stations in which
30 the articles are loaded, oriented, turned inside out, sewn in the toe area, straightened again and unloaded. One single machine of this kind carries out the production of several knitting machines. Examples of machines for sewing

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pantyhose legs are described in Nils Modig, *"Hosiery Machines: Their Development, Technology and Practical Use"*, Meisenbach Bamberg, 2nd edition, 1988, page 100 and following.

5 Machines of this kind are not suitable for automatically making socks, because in many cases labor intensive operations are required and because they are only suitable for mass production while socks are usually made in small batches.

Object and summary of the invention

10 Object of the invention is to make a device which can be easily applied to a traditional knitting machine and which can be used to close the toe of the tubular articles made by the knitting machine outside the machine itself.

An additional object of the invention is to provide a new method for the production of tubular knitted articles whose toe is closed automatically at the end of the knitting process without the need for complex handling or labor.

15 Essentially, the invention relates to a device for closing the toe of a tubular knitted article coming from the knitting machine where it is made, comprising the following combination:

- a support with a first tubular member and a second tubular member, each of which can be alternatively positioned in a first and a second station;
- 20 - a pneumatic transfer tube which can be interfaced with the articol producing machine to transfer the articles to be closed from said machine to said first station;
- in the first station, positioning members for positioning said article on said first and second tubular member which is positioned in said first station, the positioning members comprising opening means for opening the
- 25 article coming from the pneumatic transfer tube;
- in the second station, means for tensioning the toe of the tubular article and closing means for closing the toe;
- a pneumatic conduit for unloading the article after closing the toe
- 30 which can at least in part be the same tube used to transfer the article prior to sewing.

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A device of this kind can be easily interfaced with a single knitting machine or several machines by means of the pneumatic transfer tube. The articles are thus unloaded from the machine according to traditional methods with the toe open and without the need for inserting any sort of collection
5 device, apparatus or mechanism inside the machine other than a simple pneumatic transfer tube or conduit. The product received from the machine is then positioned, turned inside out, sewn or linked, or another operation is made for closing the toe, turned inside out again and finally unloaded following machining in two separate stations.

10 The article is then transferred from one station to the other by means of a system consisting of two mobile tubular members. In this way, said operations can be carried out in parallel on two articles. This partially overlaps the machining processes of two articles: while the toe of one article is closed, the next article is arranged to be closed. This substantially reduces the time
15 needed for the cycle of operations to be carried out on each article and means that a single transfer device and respective means can be used for positioning, turning inside out and closing all the tubular articles from one or more knitting machines.

These and other objects and advantages, which will be clear to experts
20 of the field in the text that follows.

According to an advantageous embodiment of the invention, the tubular member support can turn (intermittently always in the same direction or alternately) on an axis for positioning the first and the second tubular member alternatively in the first and the second station. The two tubular
25 members can be arranged either reciprocally parallel or slanted. Preferably, they are reciprocally parallel and parallel to the axis of rotation and oscillation of the respective support although other configurations are possible.

The tubular article from the knitting machine can be presented to the tubular member which is in the first station on the end of the member
30 corresponding to the position where the toe is positioned and closed. However, preferably, the article is supplied to the tubular member from the opposite side. In other words, the outlet of the pneumatic transfer tube in this

case faces towards the inside of the tubular member which is temporarily in the first station. The article is sucked by suitable suction, leaves the pneumatic transfer tube and enters inside the tubular member where it is stopped near the opposite end to the end through which it entered. Opening and positioning means are found in this position, comprising the means of turning inside out and positioning the edges to be sewn.

An arrangement of this kind results in a structure which is very simple, cost-effective and reliable, with a reduced number of parts, capable of reducing handling times of the article. The latter penetrates in the tubular member with the edge opposite to the toe to be closed first, i.e. with the toe facing upstream with respect to the advancement movement of the article along the pneumatic transfer tube and along the tubular member.

Additional advantageous characteristics and forms of embodiment of the device according to the invention are illustrated in the annexed claims.

Various forms of means for opening the tubular article can be used. Devices of the known type can be used for this purpose, which may also be different from those described below which represent a particularly advantageous form of embodiment which is innovative and currently preferred.

According to an advantageous form of embodiment of the invention, the opening means comprise gripping means (e.g. preferably pneumatic means) to grip the end of said article opposite to toe to be closed, i.e. in the case of an article in the form a sock, the elastic edge of the article. The gripping means open the elastic edge and turn it inside out on the outer surface of the tubular member.

A method for the production of a tubular knitted article with a closed toe can be implemented using a device of the type herein described, the method comprising the following phases:

- knitting said tubular article on a knitting machine;
- unloading the complete tubular article with an open toe from said knitting machine and introducing it directly into a pneumatic transfer path;

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- feeding said article to a first station where it is opened and positioned by means of said pneumatic transfer path;

- transferring the positioned article to a second station in which the toe is closed while a second tubular article is opened and positioned in said first station.

In practice, according to an advantageous embodiment of the method according to the invention, the end of the tubular article opposite to said toe is opened in the first station and the article is turned inside out.

The operations to be carried out on the tubular article can be variously subdivided between the first and second station. The article can be fed to the first station, transferred to the second station and removed from the second station. Alternatively, from here, it can be transferred back to the first station and removed pneumatically from the first station.

For example, the following phases can be envisaged:

- a first article is fitted and positioned on said first or second tubular member which is temporarily in said first station;

- the tubular member on which said first article was positioned is transferred to said second station and the other of said first and second tubular members is taken to said first station on which a second article is fitted and positioned after having removed with article whose toe was previously closed while the toe of said first article is closed in said second station.

In practice, the following sequence can be envisaged:

- the end of the first article opposite to the toe to be closed is opened and turned inside out on the outer surface of the tubular member;

- the article is turned inside out and fitted on the outer surface of said tubular member;

- the article is transferred to the second station;

- the toe is closed in said second station; and

- the article is removed.

In a modified embodiment, after closing the toe, the article can be turned inside out again from outside to inside said tubular member and removed by suction through said tubular member in the first or second station.

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In a possible embodiment, the method comprises the following phases:

- a) arranging a first tubular member in said first station;
- b) introducing a first article in said first tubular member;
- c) turning said first article inside out on the outer surface of said first
5 tubular member;
- d) transferring said first tubular member to said second station and
arranging a second tubular member in said first station;
- e) closing the toe of the first article while a second article is introduced
in the second tubular member which is temporarily in said first station and
10 turning it inside out on the outer surface of the tubular member;
- f) transferring the second tubular member to the second station and
the first tubular member to the first station;
- g) turning the first article inside out again inserting it in the first tubular
member and distancing said first tubular article by sucking it into said first
15 tubular member.

The device and method according to the invention will be described in
the context of an embodiment implementing particularly innovative means for
orienting, positioning and opening the single articles. However, it is
understood that the invention can be implemented with other orientation,
20 positioning and opening means.

Brief description of the drawings

The invention will be better understood by ensuing the description and
the enclosed drawing, which shows a practical and non limiting embodiment
of the invention. More particularly, in the drawing:

- 25 - figure 1 is a perspective view of the device for turning inside out,
transferring and closing a tubular article;
- figure 1A shows a perspective view which is similar to the view
show in figure 1 with parts removed;
- figure 2 shows a perspective view of a knitting machine equipped
30 with the device shown in figures 1 and 2;
- figure 3 shows a perspective view of the gripping member unit for
opening the article;

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- figure 4 shows a perspective view from a different point of view of the unit in figure 3 showing the opening and pressing members for turning the tubular article inside out,

5 - figure 5 shows an isolated perspective view of the means for guiding and orienting the article which is supplied to the device to be opened, turned inside out and closed in the toe area,

10 - figures 6A and 6B show two perspective views cross-sectioned along two longitudinal, reciprocally orthogonal planes of one of the tubular members with gripping members for opening the tubular article and the means for guiding and orienting the tubular article,

- figure 7 shows the effect of the guiding and orienting means on the article arriving in the tubular member;

- figure 8A shows a perspective cross-sectional view according to a longitudinal plane of one of the tubular members,

15 - figure 8B shows a perspective view of the terminal part of the pneumatic transfer tube and the tubular member support,

- figures 9A and 9B show two possible positions in which the tubular article can be arranged when it arrives at the end of the tubular member on which it must be turned inside out before the toe is closed at a later stage,

20 - figures from 10 to 13 show four subsequent phases of the opening operation involving the elastic edge of the tubular article in a cross-section which is orthogonal to the axis of the tubular member,

25 - figures from 14 to 18 show, in a longitudinal cross-section, successive phases of the reversing operation of the elastic edge of the tubular article on the external surface of the tubular member,

- figures 19 and 20 are longitudinal cross-sections showing two successive phases of the tubular article reversing operation on the outer surface of the tubular member,

30 - figures from 21A to 21D show four subsequent phases of an operation for aligning the edge of the tubular article,

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- figure 22 shows the tubular member with the article turned inside out on the outer surface prior to being transferred to the second station where the toe is closed,

5 - figures from 23 to 28 show, in a longitudinal cross-sectional view, successive phases of the operation of tensioning the article for closing the toe and the beginning of the unloading phase of the article with a closed toe,

- figures 29 and 30 are perspective views cross-sectioned along two reciprocally orthogonal longitudinal planes of a tubular member with guiding and orienting means in a different embodiment.

10 Detailed description of preferred embodiments of the invention

Figures 1, 1A and 2 show a device according to the invention applicable to a knitting machine, typically a circular knitting machine, for the production of tubular articles, such as socks, stockings or the like. The device is generically indicated with reference numeral 1 while reference numeral 2 in
15 figure 2 schematically indicates a circular knitting machine of the type known per se to which device 1 is combined.

The device 1 presents a support 3 which carries two reciprocally parallel tubular members 5A, 5B. The support 3 turns on an axis A-A which is parallel to the axis of the two tubular members 5A, 5B. The rotary movement
20 of the support 3 is controlled by an actuator 7 arranged above and carried by a fixed frame 9. The rotary movement can be proceeded by an upwards movement of the support and consequently of the tubular members which are applied to it to avoid the collision (during rotation) with the mechanical parts surrounding the lower end of the two tubular members.

25 The support 3 turns by 180° on the axis A-A and the two tubular members 5A, 5B are alternatively positioned in two stations side by side. The movement can be either an alternating movement or an intermittent rotary movement without reversing the direction of rotation.

Opening means are arranged in the first station where the tubular
30 member 5A is located in figures 1A, 1B. The opening means comprise gripping members and opening means for holding the elastic edge of each article which is supplied into the tubular member in the first station and to

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open the elastic edge on the outer surface of the tubular member itself. Additionally, means for reversing the tubular article on the outer surface of the tubular member are provided. The union of these positioning members is generically indicated by reference numeral 11 in figure 1, while a part of these members has been removed in figure 1A for greater clarity.

Angular orienting means and tensioning means are arranged in the second station, said means being generically indicated by reference numeral 13, to pull the toe of the tubular article to be closed and closing means 15, specifically a sewing machine, for closing the toe of the article by sewing or other operation (e.g. linking).

The various phases for preparing and for closing the toe of the article will be described in greater detail below.

The tubular articles made by the knitting machine 2 are supplied to the device 1 via a pneumatic transfer tube 17 presenting a terminal curve 17A arranged at an angle of 90° and facing one first end of the tubular member 5A, 5B which is temporarily in the first station, i.e. the tubular member 5A in the position shown in figures 1, 1A, 2. The pneumatic transfer tube 17 is connected to a conduit 19 leading from the lower part of the needle cylinder of the knitting machine 2. Interception means, generically indicated by reference numeral 21, are arranged between the tube 17 and the conduit 19.

The suction required for collecting the article made by the machine 2 and discharged from the needles is generated, as described below, through the tubular member 5A or 5B which is temporarily in the first station holding the interception members 21 open.

The tubular article after being closed by the sewing machine 15 in the second station is transferred again to the first station and sucked to be removed via a pneumatic unloading conduit 23. For this purpose, the conduit 23 is connected to the pneumatic transfer tube 17 and to a fitting 25 which is in turn connected to a suction device (not shown).

The article is aspirated from inside the tubular member 5A or 5B in which it is reinserted after closing the toe and transits along the tube 17 and along the conduit 23 to reach a box 27 where it is unloaded in a way which is

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known per se. In this phase, the interception means 21 are closed. After unloading the finished article, a new article is aspirated through the conduit 19 and the transfer tube 17.

The device described to this point works as follows. A first article made
5 by the machine 2 is sucked via the conduit 19 and the transfer tube 17 to reach the tubular member 5A. Since the article is made by the machine 2 starting from the elastic edge and ending with the toe, it reaches the tubular member 5A with the elastic edge first and the toe behind, i.e. downstream with respect to the direction of advancement. Having reached the lower end of
10 the tubular member 5A, the article is turned inside out on the outer surface of the tubular member 5A by the members generically indicated with reference numeral 11 and described in greater detail below.

After being positioned, the support 3 is turned by 180° and the position of the tubular members 5A, 5B is turned inside out, so that the tubular
15 member 5A is in the second station while the tubular member 5B is taken to the first station. Here, the toe of the article is pulled and sewn according to a method which is essentially similar to that described in EP-A-1118700 or the like.

During the tensioning and sewing operations, another article from the
20 machine 2 is inserted in the tubular member 5B which is temporarily in the first station. The article is turned inside out on the outer surface of the tubular member 5B and is prepared for closing the toe.

After closing the toe of the first article in the second station and positioning the second article in the first station, the support 3 turns again by
25 180° to return the tubular members 5A, 5B in the configuration shown in figure 1. The first article is sucked and unloaded along the tube 17 and the conduit 23 to permit the introduction of the next article while the toe of the second article is closed in the second station.

The article can be turned inside out the second time after closing the
30 toe in the first or second station both being equipped with means for performing the operation as illustrated below.

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As described above, it is clear that the device 1 is capable of performing the toe closing operations by working on two articles at the same time in the two stations between which the articles are transferred by mechanism 3, 5A, 5B. In this way, the operations needed to close the two overlap. Consequently, the total time required to close the toe is reduced and the device 1 can close all articles from the knitting machine 2 to which it is combined.

Figures from 3 to 7 show in detail the members for opening and turning inside out the tubular articles which are individually supplied by the pneumatic transfer tube 17 inside either one or the other tubular member 5A, 5B.

The assembly of the members 11 is carried by an annular structure 31 which is coaxial with the tubular member 5A or 5B temporarily located in the first station. The annular structure 31 is carried by a slide 33 (figure 1, 1A) moving on a vertical guide 36 parallel to the axis of the tubular members 5A, 5B. The annular structure carries a plurality of radially movable pressers 35, each of which is associated with a respective actuator 37 (see figure 4 in particular). As better described below, the pressers 35 turn the tubular article inside out on the outer surface of the tubular member 5A or 5B and other auxiliary functions.

Over the radial pressers 35, the annular structure 31 carries four linear actuators 39, e.g. cylinder-piston actuators, which control the movement of respective sliders 41 moving along guides 43, which are orthogonal to the axis of the tubular members 5A, 5B. Each slider 41 carries a respective pneumatic gripping member. The gripping members of a first pair (reciprocally counterpoised) are indicated by reference numeral 45A, while the gripping members of the second pair are indicated by reference numeral 45B. The movement of the gripping members and the sliders 41 is indicated by the double arrow f41.

Each gripping member presents a sucking head 47 applied to a first end of a tube 49 whose second end is connected by means of a flexible tube to a suction line. The flexible tubes and the suction line are not shown for the sake of simplicity of the drawing.

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A respective stem 51 (see figures 6A and 6B in detail) is associated to each gripping member 45A, 45B. The stems form opening means for opening the edge of the tubular article opposite to the toe of the article which must be closed.

5 Each stem is carried by a slide 53 moving on a guide 55 which is integral with a respective slider 41. Each slide 53 is secured by a traction spring 57 to an appendix 59 which is integral with the respective slider 41 so that the four stems 51 are elastically stressed towards the axis of the annular structure 31 and of the tubular member 5A and 5B for the purposes which will
10 be illustrated below.

A mobile unit 31 is arranged under the annular structure. The mobile unit comprises the upper end of a suction tube 61 carried by a support 63 vertically movable and controlled by an actuator (schematically referred to by numeral 64) according to the double arrow f63. The tube 61 is connected to a
15 suction source by means of a flexible tube (both not shown in the drawing).

As clearly illustrated in figure 5, which shows the suction tube 61 isolated from the other components of the device, the upper part of the suction tube 61 forms housings for the passage of the gripping members 45A, 45B, indicated by reference numeral 65. Under the housings 65, the suction
20 tube 61 presents an interception member 67 consisting of a grid to stop the sucked tubular articles from penetrating inside the tube.

Four contoured appendixes, indicated by reference numerals 71A, 71B and 73A, 73B respectively, are made on the suction tube 61 between the four housings 65. The appendixes 71A and 73A are reciprocally symmetric.
25 Similarly, the appendixes 71B, 73B are also reciprocally symmetrical.

Reciprocally symmetric contoured appendixes 71C, 73C are provided inside each of the tubular members 5A, 5B and shown isolated from the respective tubular member in figure 5. The shape of the contoured appendixes 71C, 73C is complementary with respect to the contoured
30 appendixes 71A, 71B, 73A, 73B and integral with the suction tube 61 so that the appendix 71C is inserted between the appendixes 71A, 71B forming a contoured body which shape is symmetrical with respect to that formed by the

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appendixes 73A, 73B, 73C when the latter are inserted between the appendixes 73A, 73B. The two symmetric contoured bodies are generically indicated by reference numerals 71 and 73 in figures 6A and 6B where they are shown as if they were made of a single part and where the respective
5 tubular member 5A, 5B has been removed to clearly show the shape of the contoured bodies.

The suction tube 61 is mobile in the direction of the double arrow f63 with respect to the tubular member 5A or 5B which is temporarily in the first station of the device 1 allowing the opening of the tubular article by the
10 gripping members 45A, 45B, as clearly described below.

The contoured bodies 71, 73 formed by coupling the appendixes 71A, 71B, 71C and 73A, 73B, 73C form means for guiding and orienting the tubular article which reaches the lower end of the tubular members 5A or 5B. For this purpose, the contoured bodies 71 and 73 present three main variously
15 contoured surfaces. Each body presents a first cylindrical surface, indicated by reference S_{71} and S_{73} , reciprocally, corresponding to the internal cylindrical surface of the tubular member 5A or 5B. Additionally, each body presents a orienting and guiding surface indicated by reference X_{71} and X_{73} . The development of these surfaces is essentially flat and slanted in the upper area
20 and essentially helical in the lower area. The surfaces X_{71} and X_{73} face the end of the tubular member from which the tubular knitted article to be oriented and guided comes. Moreover, each contoured body 71, 73 presents a third flat surface indicated by reference Y_{71} and Y_{73} which are parallel one with
25 respect to the other and to the axis of the respective tubular member 5A, 5B defining a passage area of the knitted article with an elongated cross-section in the lower area of the two contoured bodies near the outlet of the tubular member 5A, 5B.

The conformation of the contoured bodies 71 and 73 orients and guides the tubular article which reaches inside the tubular member 5A or 5B.
30 The effect of the conformation of the contoured bodies 71, 73 on the position of the tubular article is clearly illustrated in figures from 7A to 7F, where figure 7A is a perspective view of the two contoured bodies 71, 73 and figures from

7B to 7F are cross-sections according to planes which are orthogonal to the axis of the tubular member 5A or 5B in the positions indicated by references B, C, D, E, F in figure 7A. In these figures, reference M indicates the tubular article illustrating a transversal cross-section of the elastic edge of the article itself. In figure 7A, the article M is shown with the elastic edge folded in four and orthogonally oriented with respect to the surfaces Y_{71} , Y_{73} . This is one of the possible configurations in which the article can arrive from the pneumatic transfer tube 17. In general, the article M will always arrive approximately folded in this way, but with any angular orientation on the axis of the tubular member.

Advancing on the contoured bodies 71, 73 according to the arrow fM, the article M collides with the surfaces X_{71} and X_{73} and is so forced to turn to assume a turned orientation to a maximum of 90° with respect to the initial orientation, i.e. arranged parallelly to the surfaces Y_{71} , Y_{73} . Regardless of the position that the article M assumes when it interferes with the contoured bodies 71, 73, the surfaces X_{71} , X_{73} thereof cause the possible rotation to take the article to the final position indicated by reference M1 or to the position which is turned by 180° with respect to this position, i.e. always parallel to the surfaces Y_{71} , Y_{73} as shown in figures from 7A to 7F. This facilitates opening and turning the articles inside out by means of the previously described members, as illustrated below.

As appears in figures 6A and 6B and in detail also in figure 8A, which shows the upper end of one of the tubular members 5A, 5B, the latter each consists of two coaxial tubular elements, internal and external reciprocally, identified by references 5X and 5Y in figure 8A. The tubular element 5X can slide for a short distance inside the tubular element 5Y which is directly supported by support 3. A helical compression spring 6 housed in a gap between the two tubular elements 5X, 5Y tends to stress the internal tubular element 5X upwards, i.e. to project from the top of the tubular element 5Y. The contoured bodies 71, 73 (or more precisely the portions 71C, 73C of them) are integral with the internal tubular element 5X of the respective tubular member 5A, 5B.

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By means of the members illustrated in figure 8B and described below, the internal tubular element 5X can be pushed downwards and slide inside the tubular element 5Y whereby overcoming the elastic force of the spring 6.

For this purpose (see figure 8B), the pneumatic transfer tube 17 ends
5 with a telescopically elongating portion 17C presenting a collar 17D. Downwards elongation of the portion 17C is controlled by a pair of cylinder-piston actuators 18, one of which is visible in figure 8B while both are visible in figures 1, 1A, 2. By moving the portion 17C downwards, the collar 17D rests on a corresponding collar 5Z, which is integral with the internal tubular
10 element 5X of the tubular member 5A or 5B, which is temporarily in the first station by pushing the tubular element 5X downwards. This makes the internal tubular element 5X slide telescopically with respect to the external tubular element 5Y and pneumatically connects the pneumatic transfer tube 17 to the tubular member 5A or 5B, in order to transfer the article from the
15 machine 2 from the transfer tube 17 to the tubular member 5A or 5B. The relative telescopic sliding function of the tubular elements 5X, 5Y will be clarified in the paragraphs describing the method for turning the tubular article inside out.

The operation of the device for positioning the tubular article on the
20 tubular member 5A or 5B located in the first station for subsequently closing the toe is illustrated below.

The operations described below are carried out alternatively on the tubular member 5A and on the tubular member 5B. The operation hereof described are explained with reference to tubular member 5A. We will
25 suppose that the tubular member 5A will receive the tubular article M from the machine 2. The actuator 7 places the support 3 in an angular position so to arrange the tubular member 5A in the position of figures 1, 1A. The actuator 63 moves the suction tube 61 upwards making the appendixes 71A, 71B, 73A, 73B which are integral with it penetrate inside the tubular member 5A to
30 complete the contoured bodies 71, 73 (with the appendixes 71C, 73C). The telescopic portion 17D is lowered to pneumatically connect the tube 17 with the inside of the tubular member 5A. Vacuum is created in conduit 19, the

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pneumatic transfer tube 17 and the tubular member 5A by means of the suction tube 61 (the interception means 21 are open). As soon as the article being knitted by the machine 2 is completed, it is released by the needles and sucked towards the tubular member 5A. The article is open along both the elastic edge and the toe. It moves along the pneumatic path with the elastic edge forwards and the toe behind.

The vacuum inside the pneumatic route pulls the tubular article M until it collides against the grid 67 which is integral with the suction tube 61. Thanks to the presence of contoured bodies 71, 73 which form guiding and orientation means, the article reaches the tubular member 5A in any position and when it comes into contact with the grid 67 it is arranged in one of the two positions which are schematically illustrated in figures 9A and 9B which are orthogonal cross-sections with respect to the axis of the tubular member 5A carried out near the gripping members 45A, 45B.

In advance with respect to the arrival of the article M the gripping members 45A, 45B are positioned as shown in figures 9A and 9B: the counterpoised gripping members 45A are more distanced with respect to the counterpoised gripping members 45B. The members 45A are aligned in the direction corresponding to the greater dimension of the elongated cross-section gap defined by the surfaces Y_{71} , Y_{73} on the lower part of the contoured bodies 71, 73 while the members 45B are aligned in the direction which is orthogonal to the larger dimension.

Since the gripping members 45A, 45B are arranged directly over the grid 67, they are in the position where the elastic edge of the sock or other tubular article arriving from the knitting machine 2 is arranged and are capable of gripping this edge to open it and turn it inside out on the outer surface of the tubular member 5A as described below.

When the article M reaches either one or the other position shown in figures 9A, 9B, suction in the suction tube 61 can be discontinued and the counterpoised gripping members 45B can be reciprocally closed and pressed against the tubular article M as shown in figure 10. Having reached this position, suction can be activated through the gripping members 45B so that

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they can grip the edge of the tubular article in two counterpoised areas. At the same time, the suction tube 61 can be moved downwards and distanced by the actuator 63. In this way, a gap is created around the gripping members 45A, 45B, said gripping members being under the lower edge of the tubular member 5A.

The opening movement of the gripping members 45B controlled by the respective actuators 39 thus opens the tubular article M which assumes the position shown in figure 11 in the area projecting from the lower inlet of the tubular member 5A.

Subsequently, the gripping members 45A are reciprocally approached and pressed against the edge of the tubular article M in the area comprised between the two gripping members 45B, as shown in figure 12. After pressing the tubular article M between the two front surfaces of the gripping article 45A, the latter are activated by creating inside a suction so that the tubular article is engaged by the members. The following opening movement of the gripping members 45A causes the complete opening of the article M which assumes the position shown in figure 13.

Figure 14 shows a longitudinal cross-section of the tubular member 5A while opening the elastic edge of the article M. Reference MB indicates the elastic edge of the article and reference MP indicates the toe, i.e. the edge intended to form the closed toe of the article after being closed in the second station of the device 1. Figures 15 and 20 show the operations for turning the tubular article M inside out on the tubular member 5A according to the same cross-section.

In figure 15, stems 51 have been inserted inside the open edge MB of the tubular article M. The stems withhold the edge after deactivating the gripping members and the fabric of the edge MB no longer adheres to them. The actuators 39 open the stems 51 as shown by the arrows in figure 15 to reach the position shown in figure 16. Here the four stems 51 (of which only two appear in the cross-section view) are in such a widely open position that the edge MB of the article M is arranged clear of the inlet of the tubular member 5A. It is not ruled out that the opening operations be carried out by

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different means, e.g. by a single set of gripping means also of the mechanical type. However, the arrangement herein described is particularly reliable because it avoids accidentally damaging the fabric which forms the article.

As shown in figures 14 and 15, when opening the edge MB of the article M the internal tubular element 5X is in retracted position, i.e. made to retract along the tubular element 5Y. This is obtained by returning the collar 17D and the portion 17C of the pneumatic transfer tube 17 upwards (figure 8B). Conversely, in figure 16, the internal tubular element 5X is pushed again in the lower position, i.e. with the inlet aligned with the inlet of the external tubular element 5Y. This movement modifies the position of the appendixes 71C, 73C which are integral with the tubular element 5X with respect to the lower inlet of the tubular member 5A.

An upwards movement according to the arrow f31 of the annular structure 31 which carries the stems 51 causes the elastic edge MB of the article M to be turned inside out on the outer surface of the tubular member 5A, as shown in figures 17 and 18. The stems 51 are retracted.

After turning the edge MB of the article M on the outer surface of the tubular member 5A, the radial pressers are pressed against the edge itself and the structure 31 which also carries said radial pressers is additionally moved upwards (see figure 19, 20). In this way, the radial pressers 35 move the tubular article M turning it inside out from inside to outer surface the tubular member 5A to also take the edge MP formed by the edges of the toe to be closed on the outer surface of the tubular member. More than one travel of the structure 31 may be needed in the case of long articles in which the open radial pressers 35 are moved downwards and upwards again with the radial pressers 35 closed on the tubular member 5A.

When the edge MP intended to form the closed toe is taken onto the outer surface of the tubular member 5A, i.e. when the article M has been completely turned inside out and is on the outer surface of the tubular member, a sequence consisting in raising, turning by 180° and lowering the support 3 carrying the tubular member 5A to the second station for closing the toe is performed.

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Preliminarily the edge MP may need to be aligned and taken parallel to the inlet edge of the tubular member 5A. This operation can be performed in the first or the second station and is illustrated in figures from 21A to 21D. In figure 21A, the article M is entirely turned inside out on the outer surface of the tubular member 5A and the edge MP intended to form the closed toe is arranged in a casual, irregular retracted position with respect to the terminal edge of the tubular member 5A. The radial pressers 35 are arranged in correspondence with the terminal area of the tubular member under the edge MP and approached to the external surface of the tubular member. They are then lifted to meet the edge MP and make the edge slide upwards for a distance which is sufficient to ensure that the edge MP is resting on all pressers 35 (figure 21B). In this way, the edge MP is approximately aligned on an ideal circumference which is on top tangent the radial pressers 35. At this point, the pressers 35 are opened and additionally moved upwards to a height which is immediately over the edge MP (figure 21C) and closed to press on the tubular article M. In the following phase, the closed pressers are lowered to align the edge MP with the lower terminal edge of the tubular member 5A in the configuration of figure 21D. The process can be controlled, for example by means of optical sensors (not shown). In figure 21D, the edge MP is aligned on a plane which is orthogonal with the axis of the tubular member and which contains the lower edge of the tubular member 5A. The procedure for aligning the edge MP could be carried out in the second station with similar radial pressers which are provided in said station for other functions as illustrated below.

Figure 22 shows a longitudinal cross-section of the tubular member 5A after the operation consisting in turning the article inside out and aligning the edge MP of the article before rotating the support 3 by 180° which transfers the tubular member 5A to the second station.

Figures 23 and 27 show the operations of tensioning the tubular article in the second station before closing the toe.

An annular structure 81 which is similar to structure 31 is arranged in the second station and carried by a slide 83 moving on a vertical guide 85

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(see figures 1 and 2). The annular structure 81 presents radial pressers 87 which are operated by actuators 89, similar to the radial pressers 35 and the respective actuators 37. The annular structure 81 with the radial pressers which are fitted on it is angularly mobile on its axis coinciding with the axis of the tubular member 5A or 5B temporarily located in the second station. The angular movement is provided by an actuator 90 (figures 1-2).

In this way, the radial pressers 87 are pressed against the outer surface of the tubular article M, the edge MP of the tubular article can be positioned angularly with respect to the tubular member 5A to take the two edges to be joined to form the closed toe and align them with two slots or grooves 5D diametrically opposed along the terminal area of the external tubular element 5Y from the edge of the latter and visible in particular in figure 25. If the tubular member 5A is angularly fixed with respect to the support 3 or if its angular position is known, the angular position of the slots 5D is known beforehand. A photocell or other optical sensor 91 (shown in figure 25) can be used to identify the correct angular position of the tubular article M, e.g. by marking by knitting in a thread of suitable color. This angular orientation operation of the tubular article with respect to the tubular member on which the article is fitted can be carried out also in the first station instead of the second. Furthermore, it can be carried out also by turning the tubular member and keeping the article angularly stopped by means of the radial pressers. In general, the angular orientation is obtained, consequently, by reciprocally moving the article which respect to the tubular member where the fixed element can be either one or the other.

After angularly aligning the tubular article M (figures 23, 24) or during said operation, two brackets 13A belonging to the tensioning means 13 can be introduced inside the tubular member from the bottom (figures 24, 25). After angular positioning, the brackets 13A can be opened (figure 26) projecting outwards radially from the tubular member 5A through the diametrically opposite slots 5D to tension the edge MP of the article, as shown in figure 26. A subsequent downwards movement of the brackets 13A carries the tensioned edge under the lower edge of the tubular member into an area

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in which it is sewn by sewing machine 15 or other suitable means, equipped for example with a guillotine in which the fabric of the edge MP penetrates. The closing operation is carried out in a way which is known per se and will not be described herein.

5 After closing the toe, the article M can be turned inside out again penetrating inside the tubular member 5A and removed. This operation is carried out again by the radial pressers. In the example shown, since there is only one pneumatic transfer tube 17 used to supply the new articles to be closed and to move the closed articles away, the second operation consisting
10 in turning the article inside out and distancing it are carried out in the first station where the tubular member 5A is returned by a new 180° rotation of the support 3. Consequently, in this case, the radial pressers 35 carry out the second operation consisting in turning the article inside out while an upwards suction is generated inside the tubular member 5A. Figure 28 shows the initial
15 phase of the second inside out turning operation which is obtained by one or more alternating strokes of the radial pressers 35 until the elastic edge MB is sucked into the tubular member 5A.

The possibility of unloading the closed articles in the second station is not excluded. For example, a suction conduit similar to the transfer tube 17
20 can be provided and arranged over the transfer means in line with the tubular member 5A or 5B which is temporarily in the second station. In this case, the second operation consisting in turning the tubular article inside out after closing the toe is carried out in the second station by means of the radial pressers 87.

25 Naturally, in this case, the distribution of the various phases between the two stations will be different. In any case, the sequence will entail that the operations of opening the elastic edge MB and closing the toe MP must necessarily be carried out in two different stations, i.e. in the first station and in the second station. The remaining operations on the other hand can be
30 carried out in either one or the other of the two stations and distributed according to the need or choice of the operator, always considering the need to minimize the total time needed to close the toe. Particularly, the angular

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orientation of the article (figures 23, 24) can be carried out in the first station in which case the annular structure 31 will be angularly mobile. Alignment of the edge MP (figures 21A-21D) can in principle be carried out by means of the radial pressers 87 in the second station. As mentioned, the second operation
5 consisting in turning the article inside out and unloading it could be carried out in the second station.

Figures 29 and 30 show a different embodiment of the device according to two cross-sectional views which are similar to the cross-sectional views shown in figures 6A and 6B. The same reference numbers indicate
10 parts which are the same or correspond to those in figure 6A, 6B. This second embodiment differs from the previous one for the different configuration of the guiding and orienting means upwards with respect to the gripping means. In this case, the terminal portion (lower) of the tubular members 5A, 5B consists of an internal frusto-conical surface 101 which guides the elastic edge MB of
15 the tubular article towards four cylindrical surfaces 103 which are arranged in correspondence with the gripping members 45A, 45B. In this way, the edge of the tubular article is tightened on the axis of the other tubular member and is gripped by the gripping means. The solution is less advantageous than the previous one because the position in which the tubular article is arranged is
20 not determined and several repeated movements of the gripping members 45A, 45B may be needed for opening it.

The second embodiment differs from the previous one also because in the first embodiment a collar 8 is provided to reduce the cross-section of the tubular member 5A, 5B. The collar presents a contoured lead-in cross-section
25 to facilitate the passage of the tubular article. This prevents the article from colliding into the contoured bodies 71, 73, and by restricting the incoming product, arranges it for the subsequent orientation.

It is noted that the drawing is provided by the way of an example only and that numerous changes can be implemented to the construction and
30 embodiments of the invention herein envisaged without departing from the scope of the present invention. The presence of reference numerals in the annexed claims has the purpose of facilitating comprehension of the claims

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with reference to the description and does not limit the scope of protection represented by the claims.

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CLAIMS

1. Device for closing the toe of a tubular knitted article from the knitting machine where it is made comprising the following combination:

- a support with a first tubular member and a second tubular member,
5 each of which can be alternatively positioned in a first and a second station;
- a pneumatic transfer tube which can be interfaced with the knitting machine where the article is made to transfer the articles to be closed from said machine to said first station;
- in the first station, positioning members for positioning said article
10 on said first and second tubular member in said first station, the positioning members comprising opening means for opening the article coming from the pneumatic transfer tube;
- in the second station, means for tensioning the toe of the tubular article and closing means for closing the toe;
- 15 - a pneumatic conduit for unloading the article after closing the toe.

2. Device according to claim 1, in which said support can turn on an axis to position said first and second tubular members alternatively in said first and in said second station.

3. Device according to claim 2 or 3, in which said first and said second
20 tubular member are essentially reciprocally parallel.

4. Device according to claim 2 and 3, in which said tubular members are parallel to the axis of rotation of said support.

5. Device according to one or more of the claims above, in which in said first station the positioning members position the article to be closed on a
25 first end of the tubular member which is temporarily in said first station, said article being inserted in said tubular member by pneumatic transfer tube on the opposite end of said tubular member.

6. Device according to one or more of the claims above, in which an actuator is provided in said second station to turn the article with respect to
30 the tubular member which is temporarily in said second station.

7. Device according to one or more of the claims above, in which members for turning the tubular article inside out are provided in said first

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station, the members turning said article inside out fitting it from inside to the outer surface of the tubular members which is temporarily in said first station.

8. Device according to one or more of the claims above, in which suction means are arranged in the first station for sucking the article inside the tubular member which is temporarily in said first station.

9. Device according to one or more of the claims above, in which said opening means comprise gripping means for gripping the end of said article which is opposite to the end to be sewn.

10. Device according to claim 9, in which said opening means comprise opening members for stretching said end and fitting it outside the tubular member which is temporarily in said first station.

11. Device according at least to claim 7, in which said members for turning the article inside out comprise pressers which are radially and axially mobile along the tubular member which is temporarily in said first station for turning the tubular article inside out by removing it from inside said tubular member and taking it onto its outside surface.

12. Device according to claim 6, in which said actuator for turning the article and the tubular member on which the article is arranged one respect to the other are arranged in the second station.

13. Method for the production of a tubular knitted article with closed toe, comprising the following phases:

- knitting said tubular article on a knitting machine;
- unloading the tubular article with an open toe from said knitting machine and introducing it directly into a pneumatic transfer path;
- feeding said article to a first station where it is opened and positioned, by means of said pneumatic transfer path;
- transferring the positioned article to a second station in which the toe is closed while a second tubular article is opened and positioned in said first station;
- removing said first article after closing the toe.

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14. Method according to claim 13, in which in said first station the end of the tubular article opposite to said toe is opened and the article is turned inside out.

15. Method according to claim 13 or 14, in which a first and a second tubular member is alternatively positioned in said first and said second station.

16. Method according to claim 15, in which said tubular article is inserted from said pneumatic transfer path inside said first or second tubular member from one end thereof with the edge opposite to the toe to be closed in an advanced position with respect to the toe, said edge being turned inside out on the outside of the tubular member in correspondence with its end which is opposite the end on which said article is inserted in said tubular member.

17. Method according to claim 15 or 16, in which:

- a first article is positioned on said first or second tubular member which is temporarily in said first station;

- the tubular member on which said first article was positioned is transferred to said second station and the other of said first and second tubular members is taken to said first station on which a second article is positioned while the toe of said first article is closed in said second station.

18. Method according to claim 17, in which:

- the end of the first article opposite to the toe to be closed is opened and turned inside out on the outer surface of the tubular member;

- the article is turned inside out and fitted on the outer surface of said tubular member;

- the article is transferred to the second station;

- the toe is closed in said second station; and

- the article is removed.

19. Method according to claim 18, in which after closing the toe the article is turned inside out again from the outside to the inside of said tubular member and removed by suction through said tubular member.

20. Method according to one or more of the claims from 13 to 19 comprising the following phases:

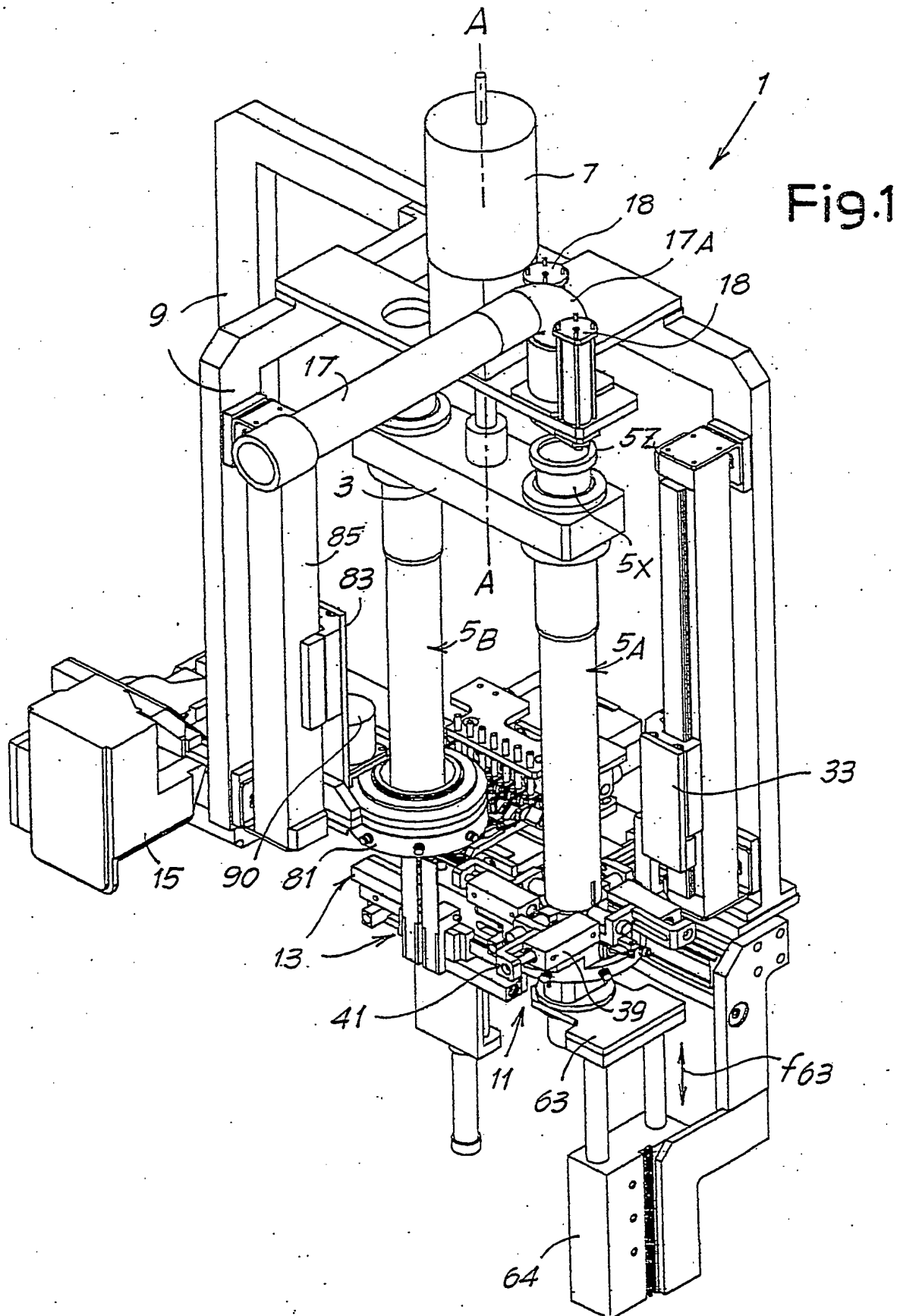
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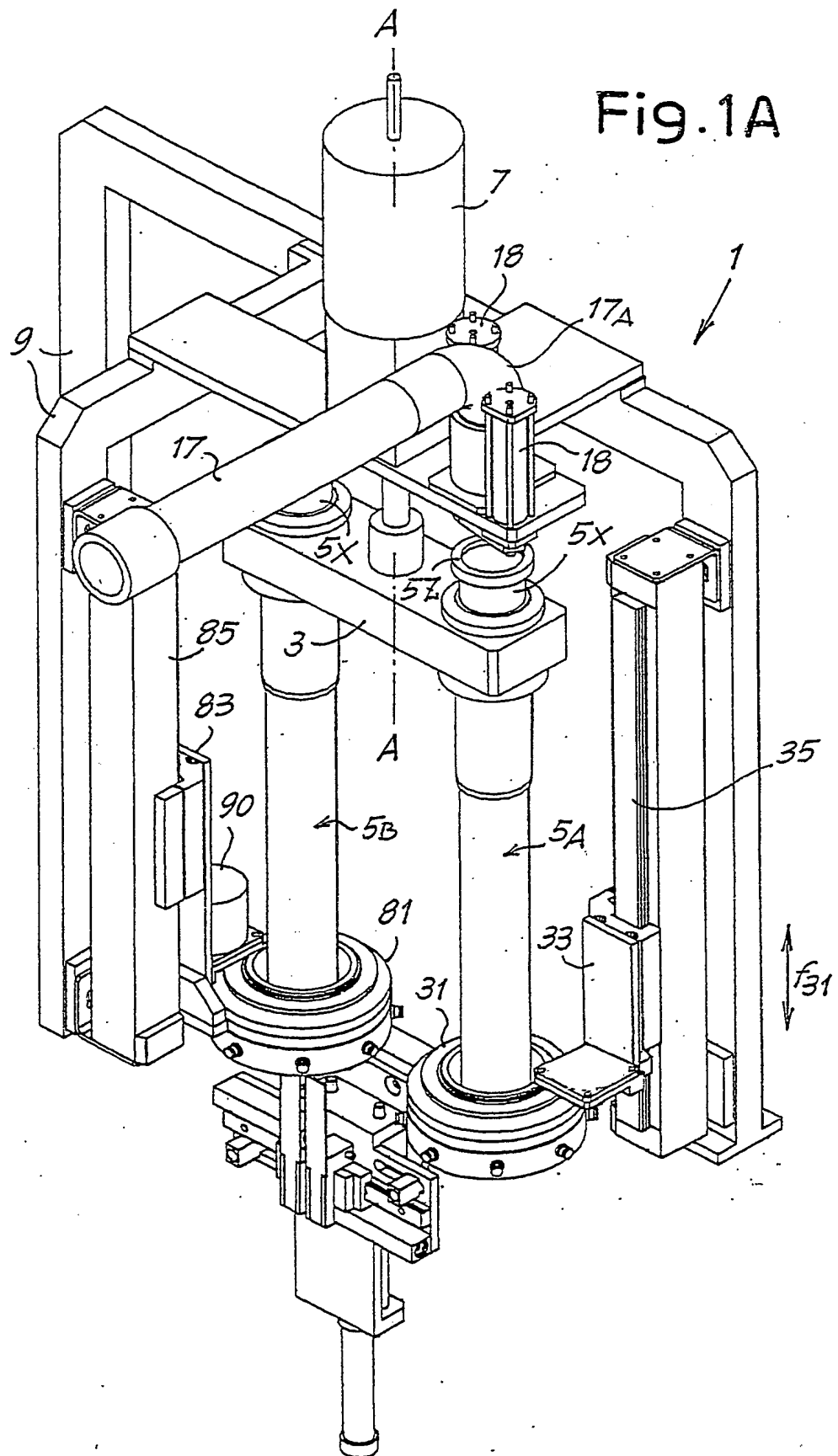
- a) arranging a first tubular member in said first station;
 - b) introducing a first article in said first tubular member;
 - c) turning said first article inside out on the outer surface of said first tubular member;
 - 5 d) transferring said first tubular member to said second station and arranging a second tubular member in said first station;
 - e) closing the toe of the first article while a second article is introduced in the second tubular member which is temporarily in said first station and turning it inside out on the outer surface of the tubular member;
 - 10 f) transferring the second tubular member to the second station and the first tubular member to the first station;
 - g) turning the first article inside out again inserting it in the first tubular member and removing said first tubular article by sucking it into said first tubular member.
- 15 21. Method according to one or more of the claims from 13 to 19, comprising the following phases:
- a) arranging a first tubular member in said first station;
 - b) introducing a first article in said first tubular member;
 - c) turning said first article inside out on the outer surface of said first
 - 20 tubular member;
 - d) transferring said first tubular member to said second station and arranging a second tubular member in said first station;
 - e) closing the toe of the first article and turn inside out the first article again while a second article is introduced in the second tubular member which
 - 25 is temporarily in said first station and turning it inside out on the outer surface of the tubular member;
 - f) removing the first article;
 - g) transferring the second tubular member to the second station and the first tubular member to the first station.
- 30 22. Method according to one or more of the claims from 13 to 19, comprising the following phases:
- a) arranging a first tubular member in said first station;

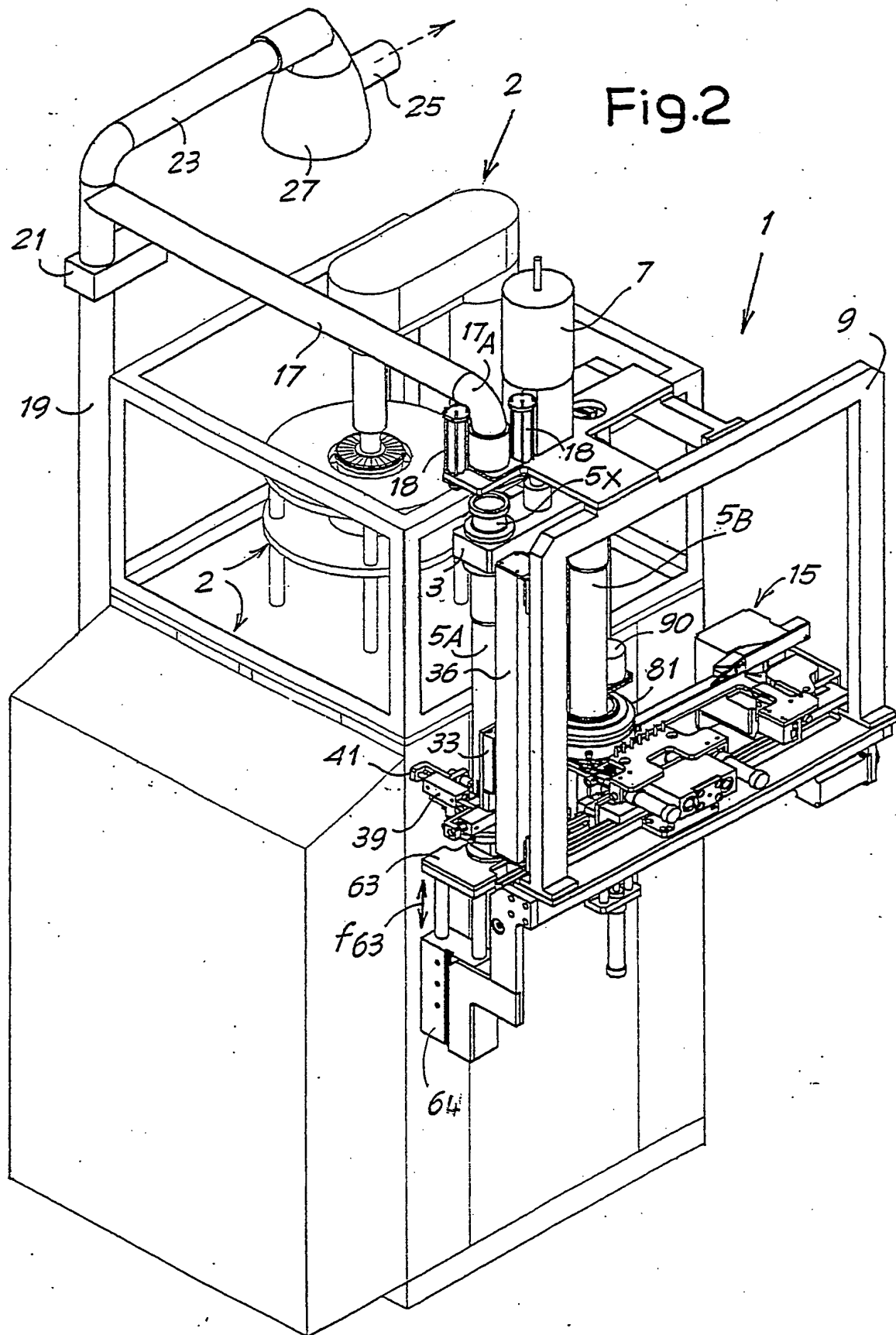
- 29 -

- b) introducing a first article in said first tubular member;
- c) transferring said first tubular member to said second station and arranging a second tubular member in said first station;
- d) turning said first article inside out on the outer surface of said first
5 tubular member;
- e) closing the toe of the first article while a second article is introduced in the second tubular member and turned inside out;
- f) transferring the second tubular member to the second station and the first tubular member to the first station;
- 10 g) turning the first article inside out again inserting it in the first tubular member and removing said first tubular article.

23. Knitting machine equipped with a device according to one or more of the claims from 1 to 11.







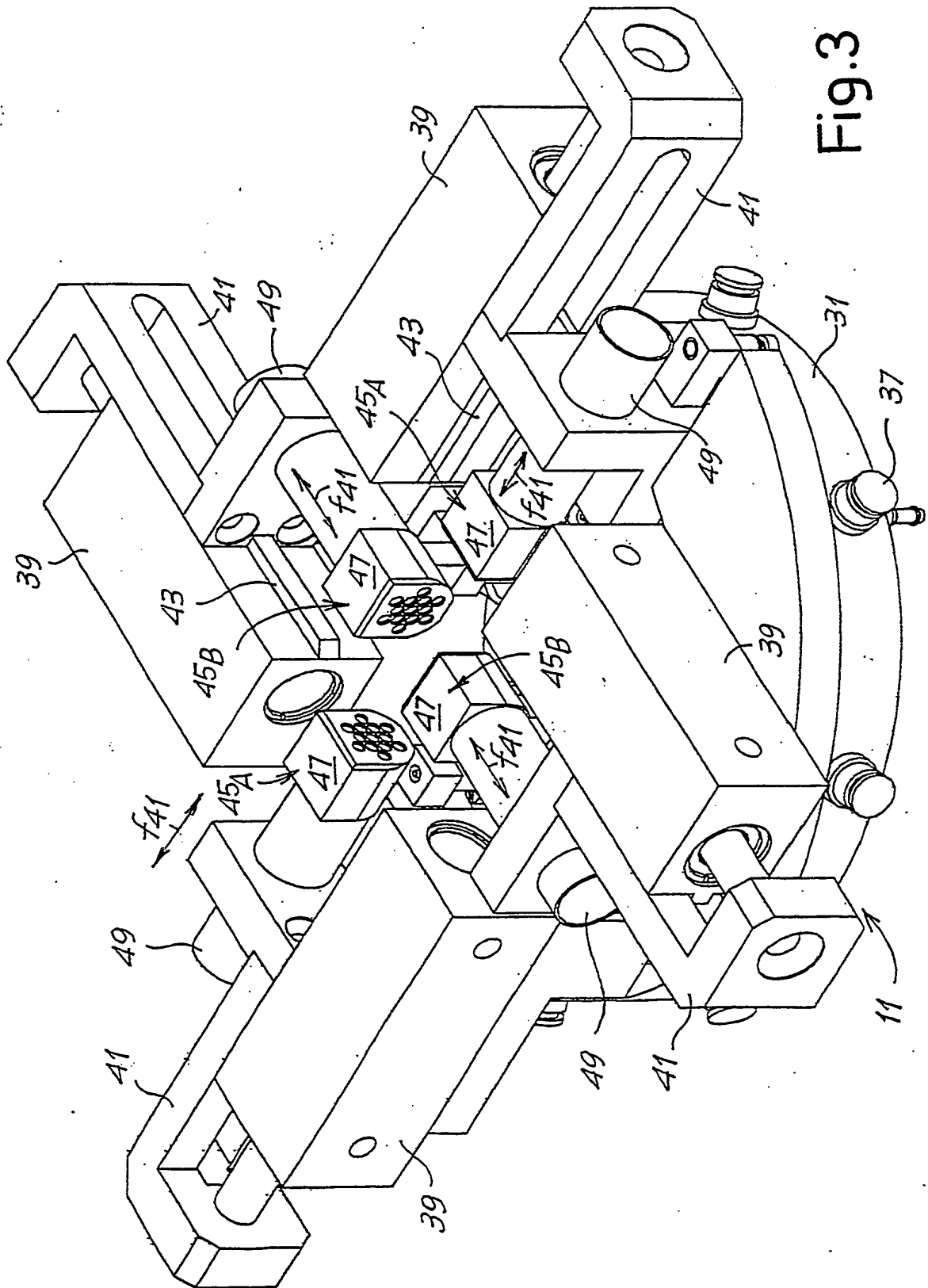


Fig. 3

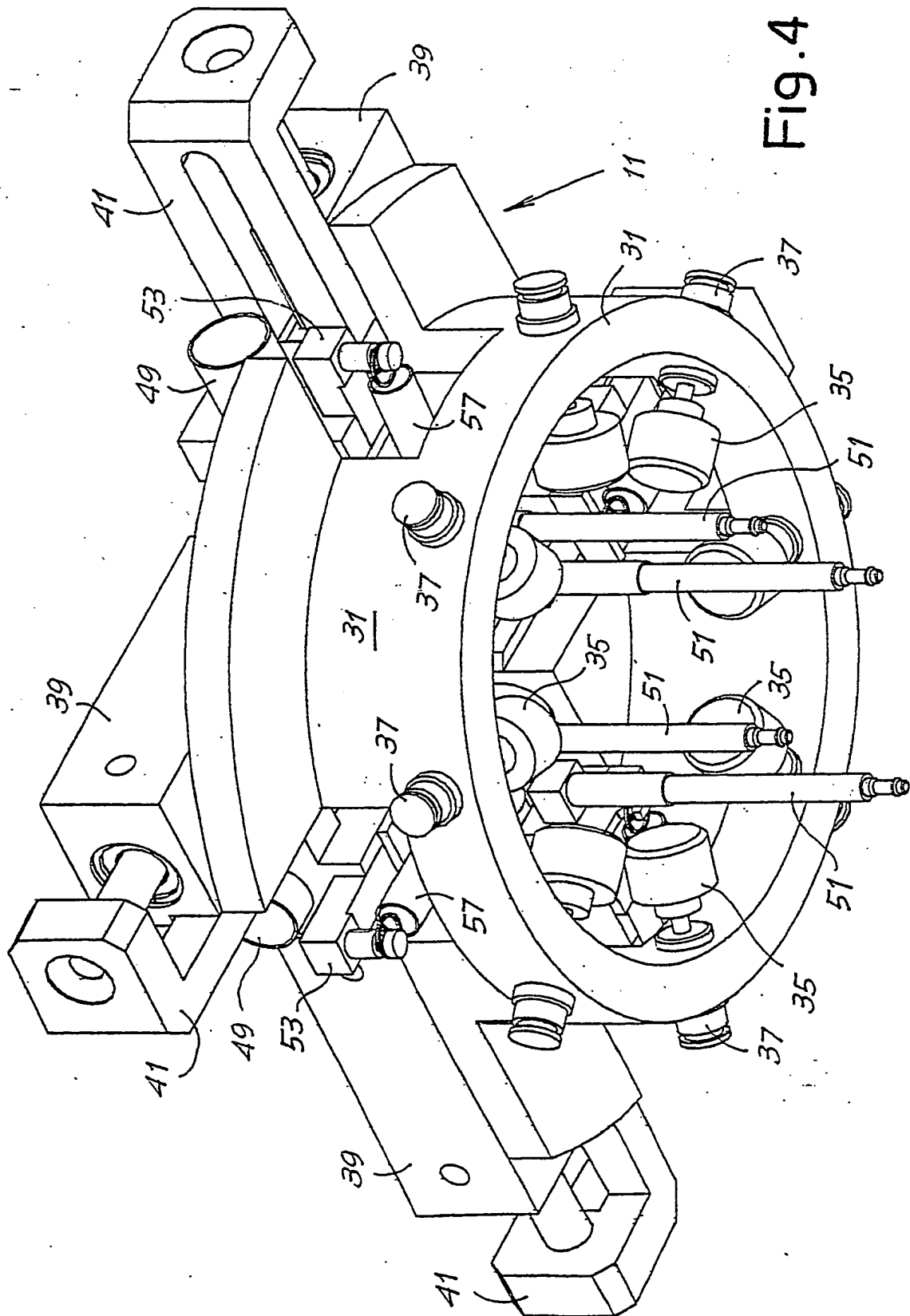
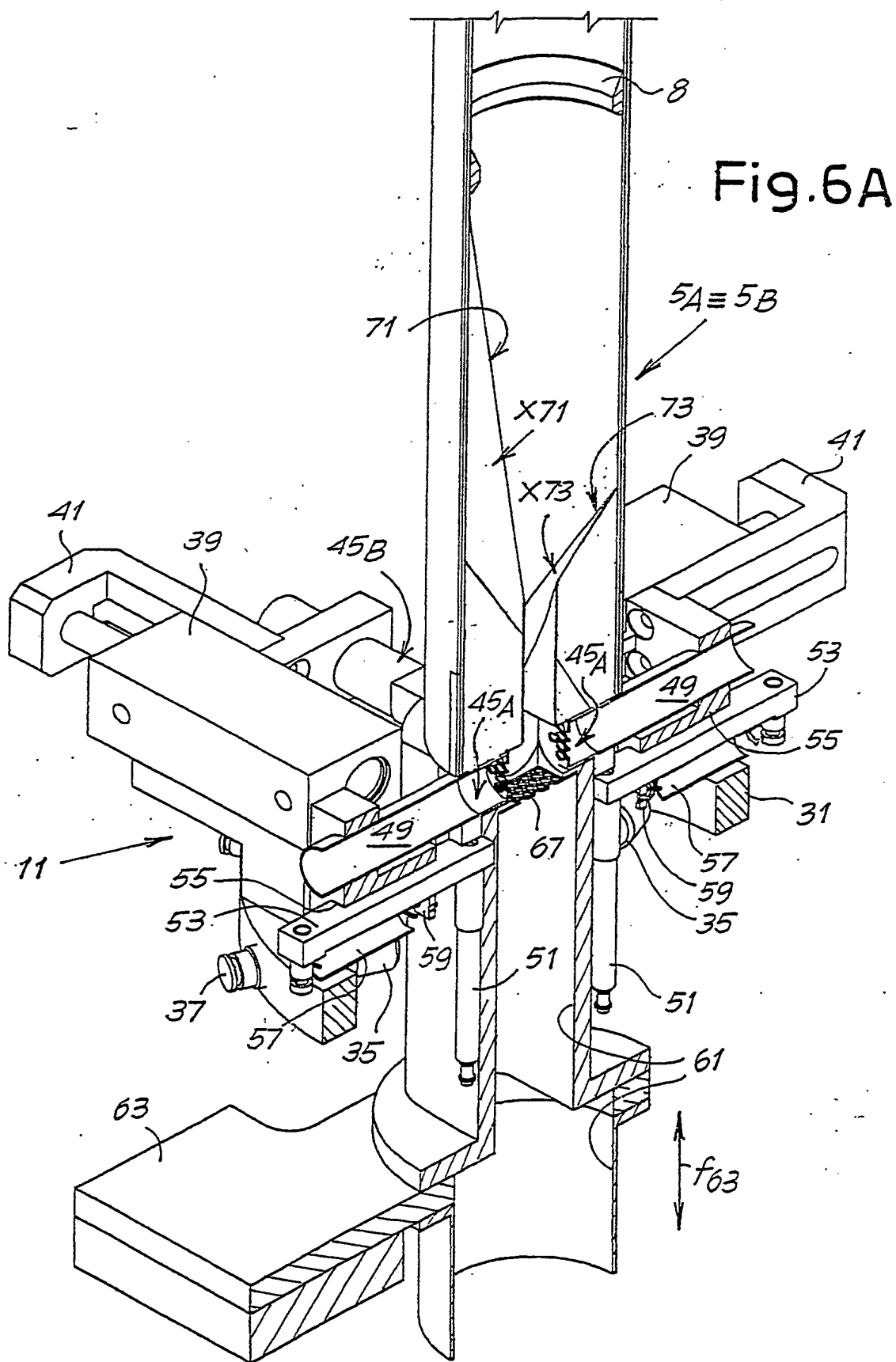
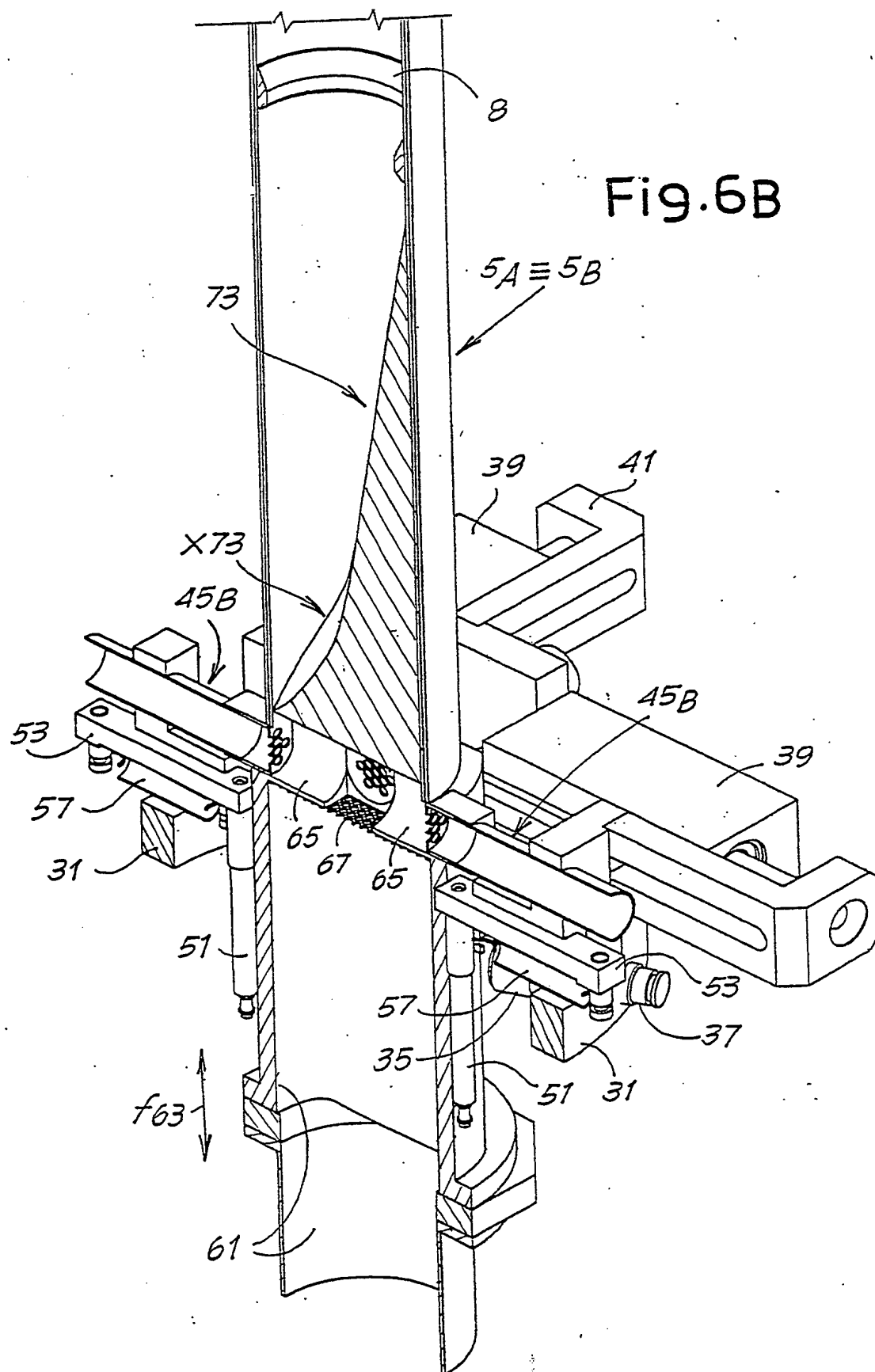
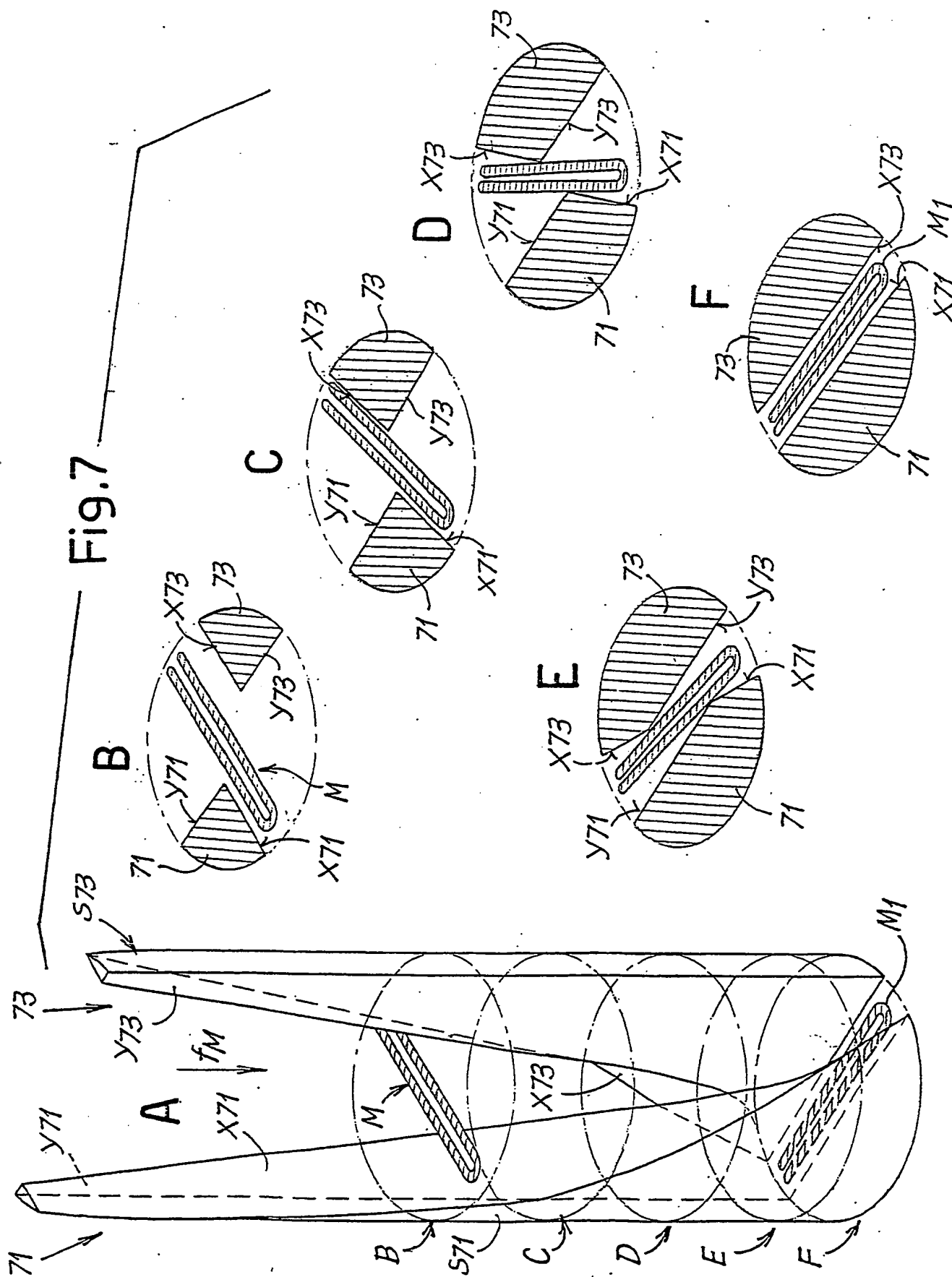
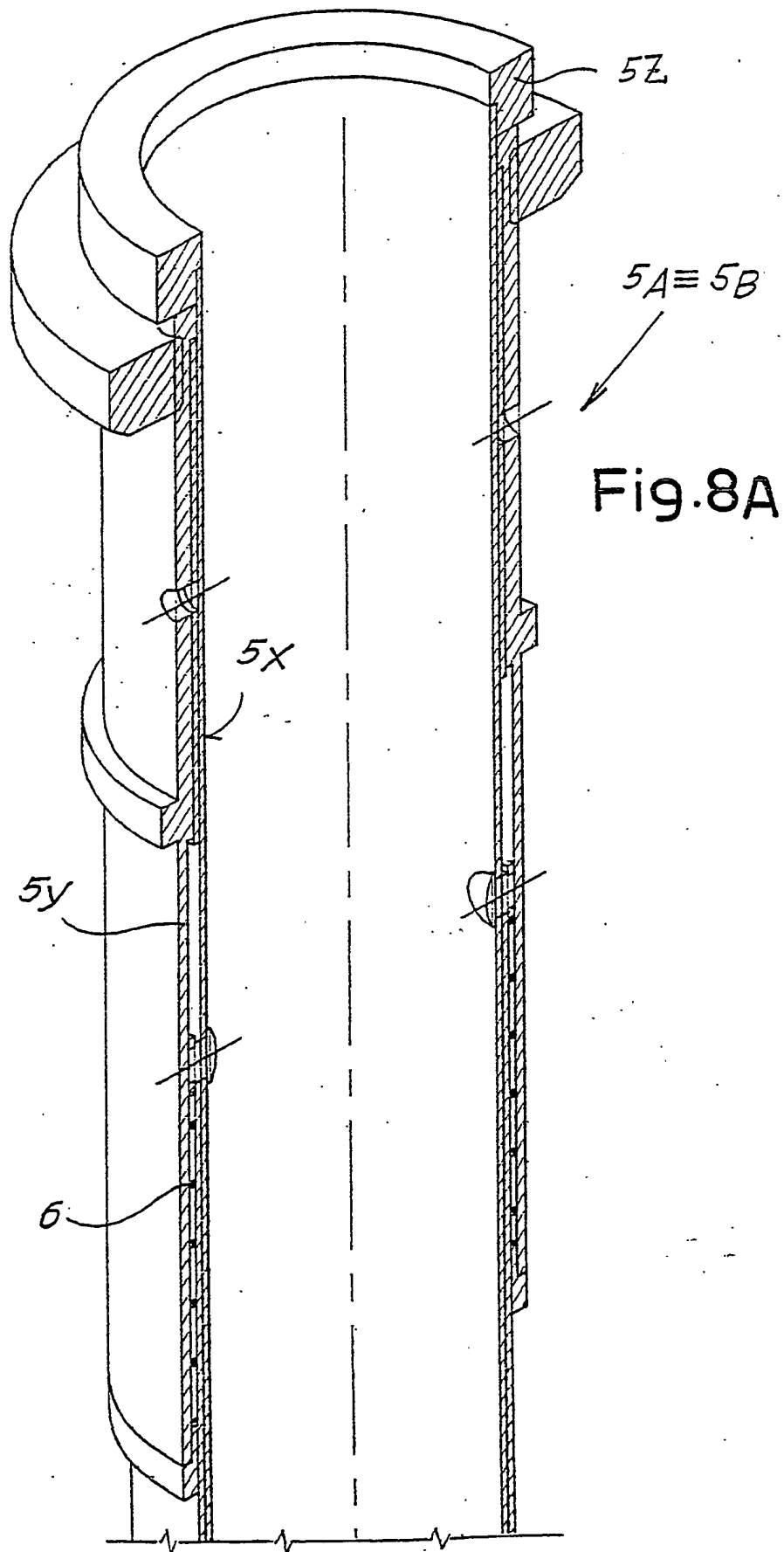


Fig. 4









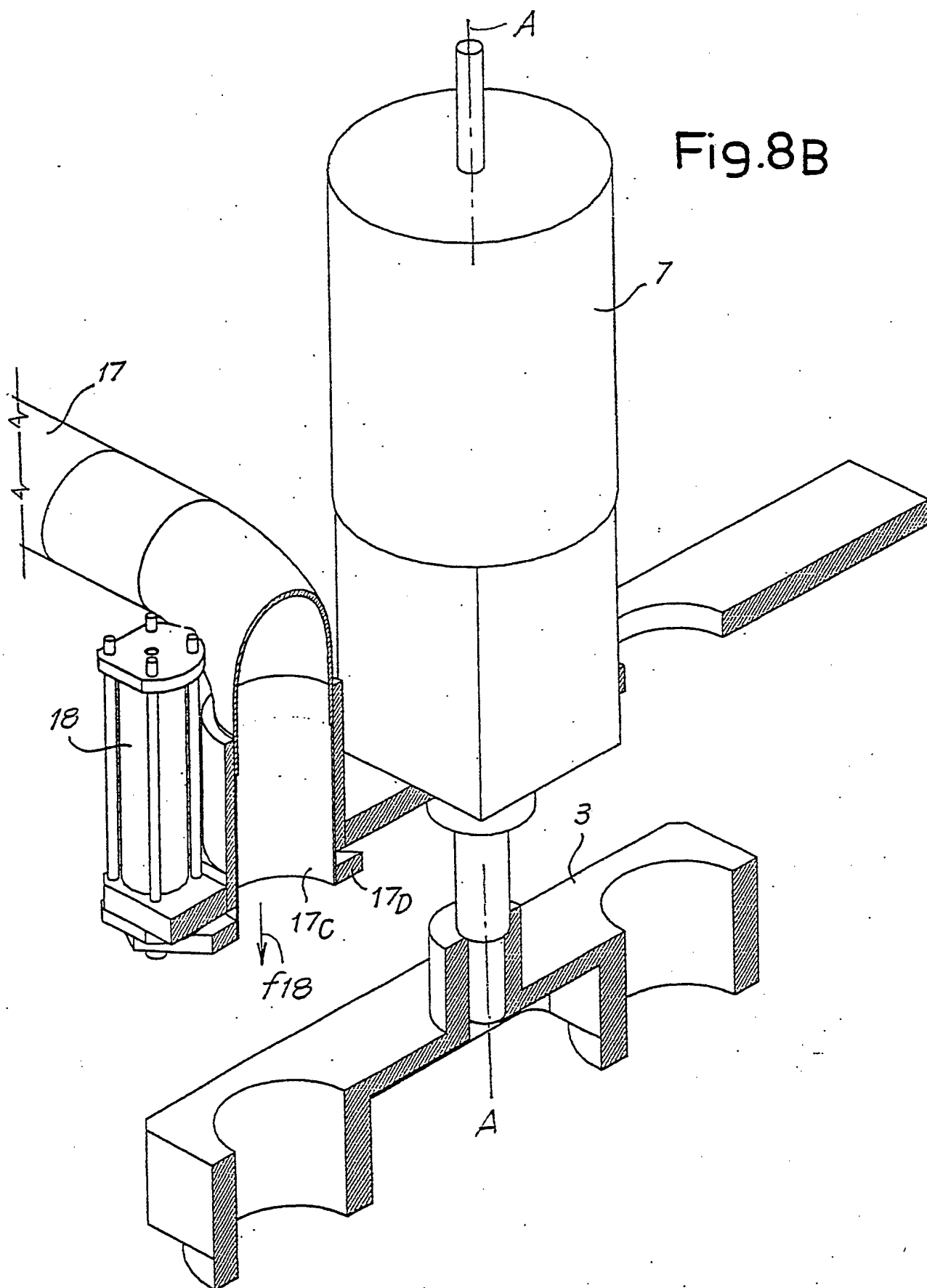


Fig.9A

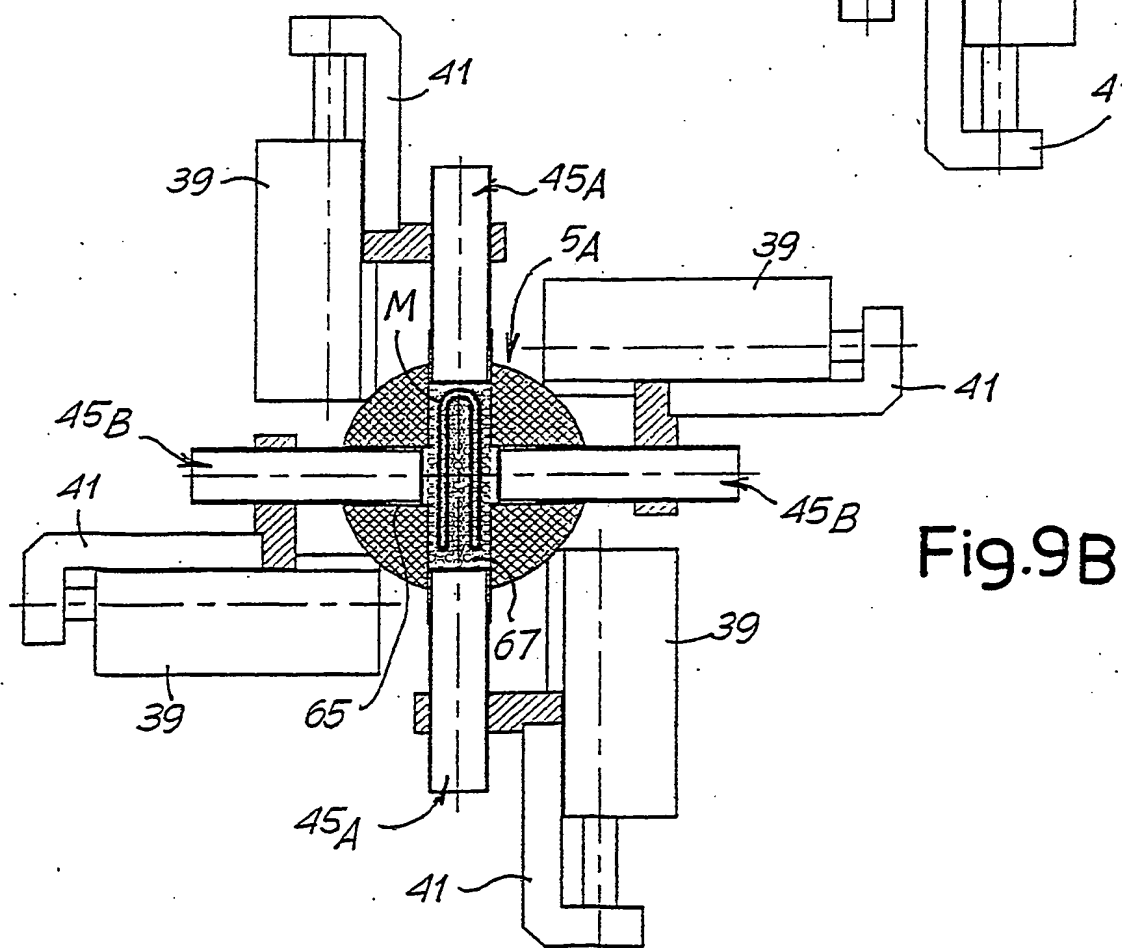
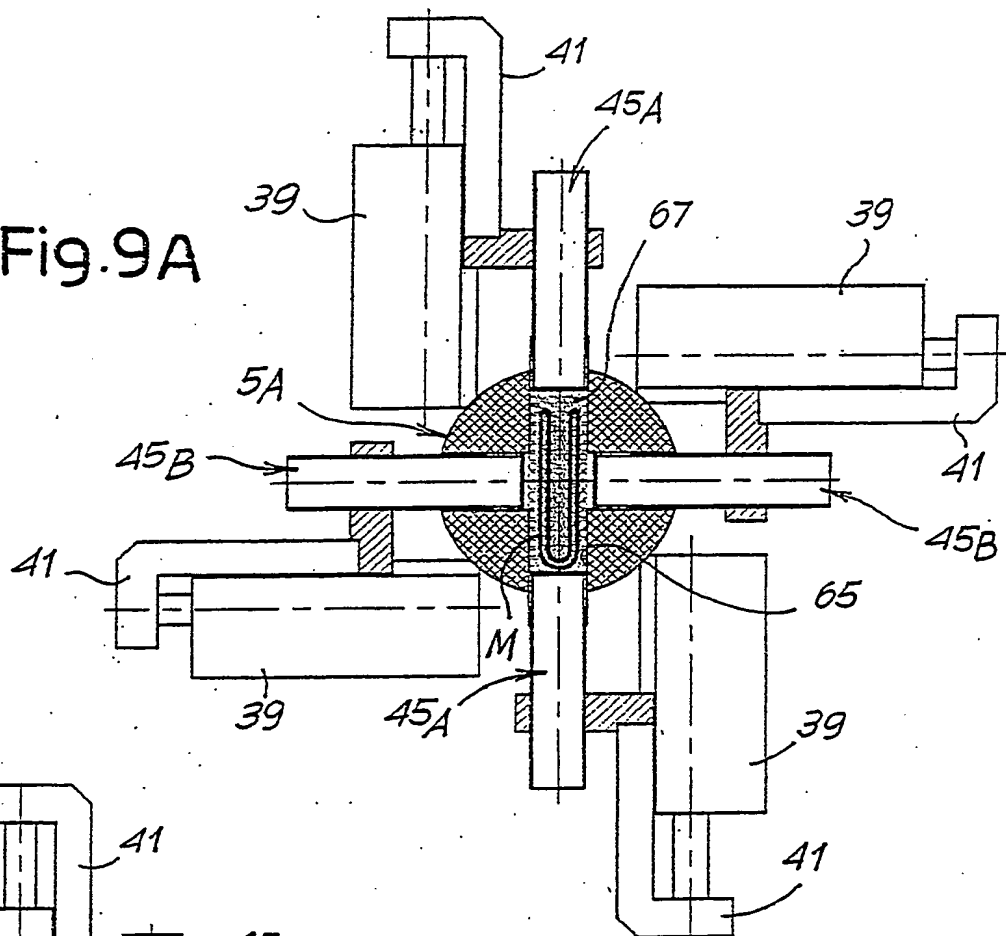


Fig.9B

Fig 10

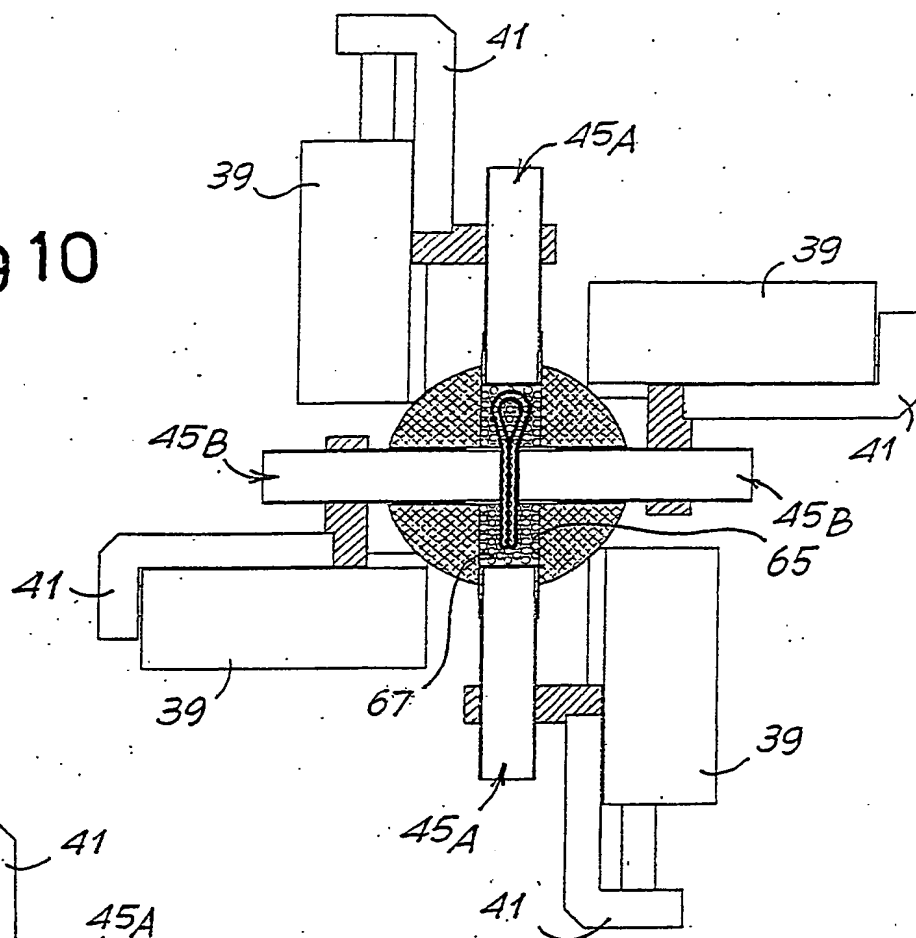


Fig.11

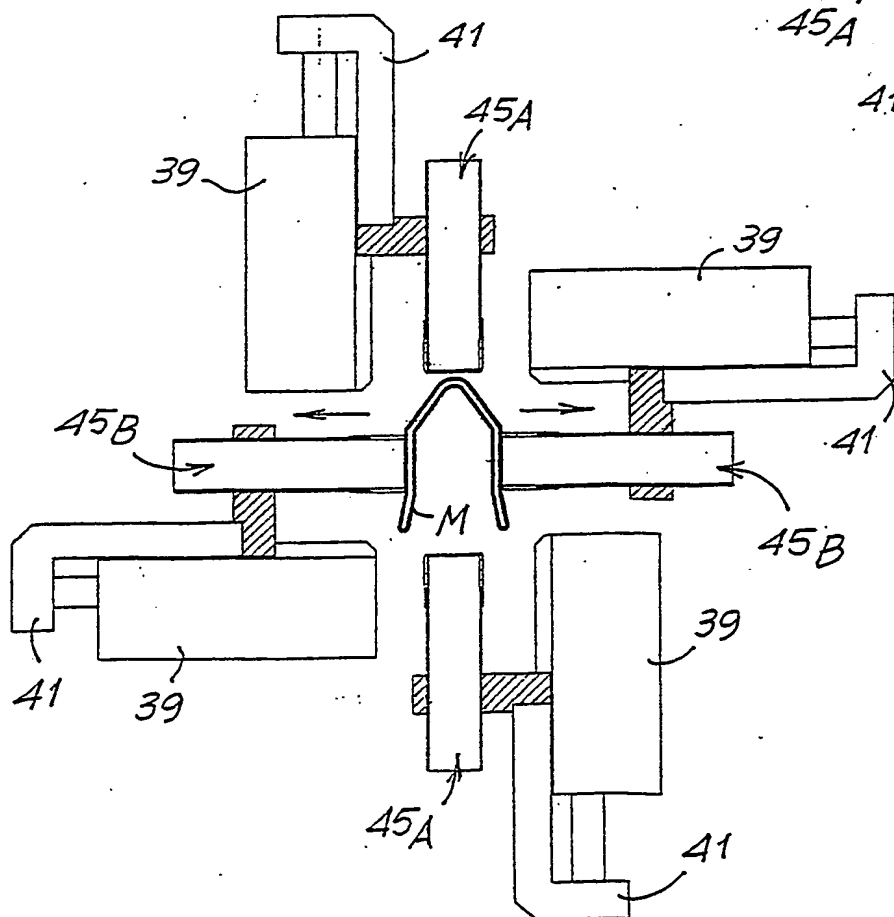


Fig.12

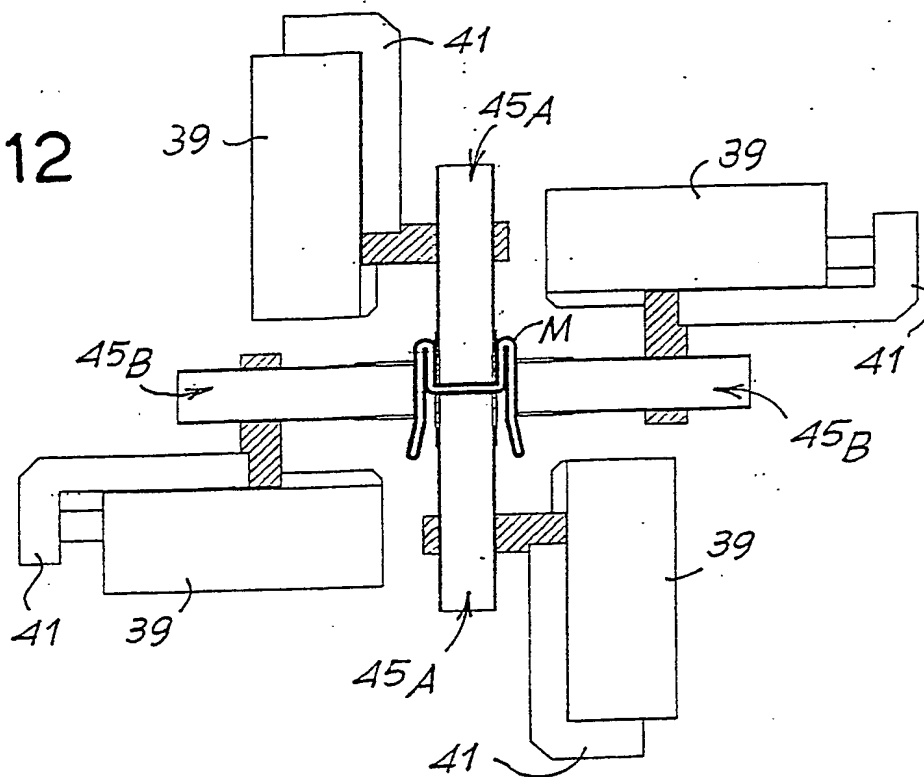
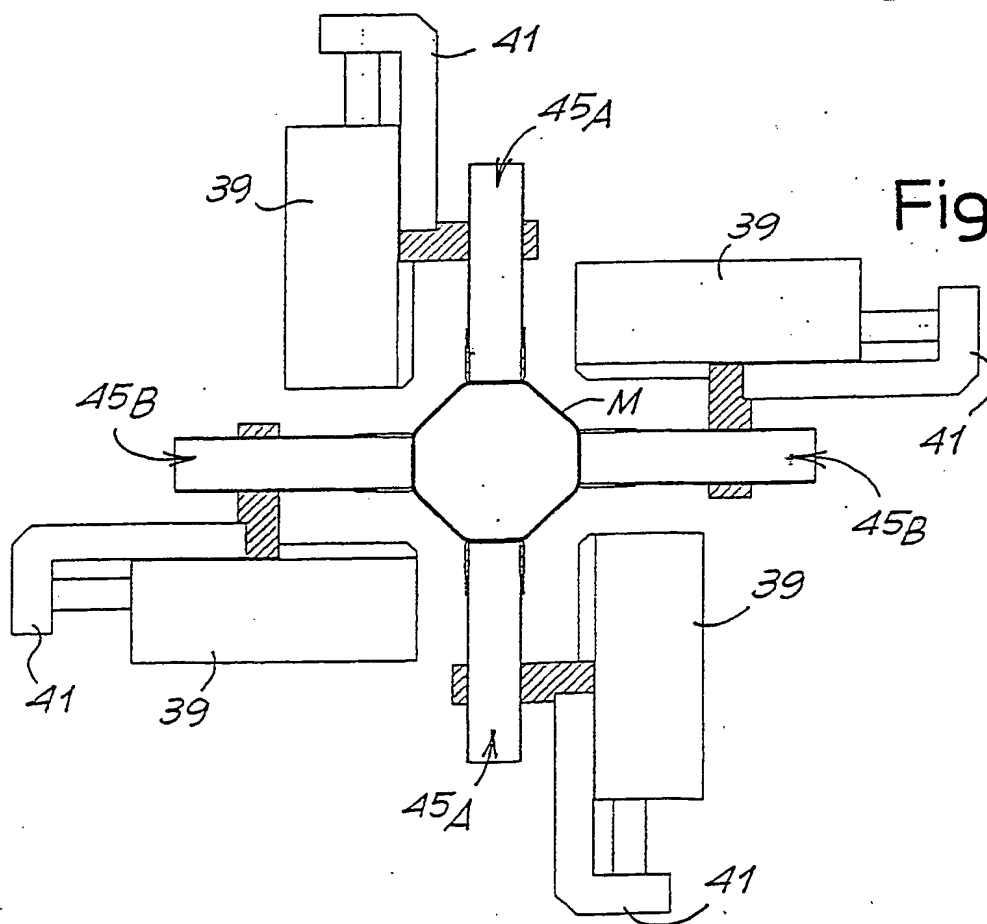
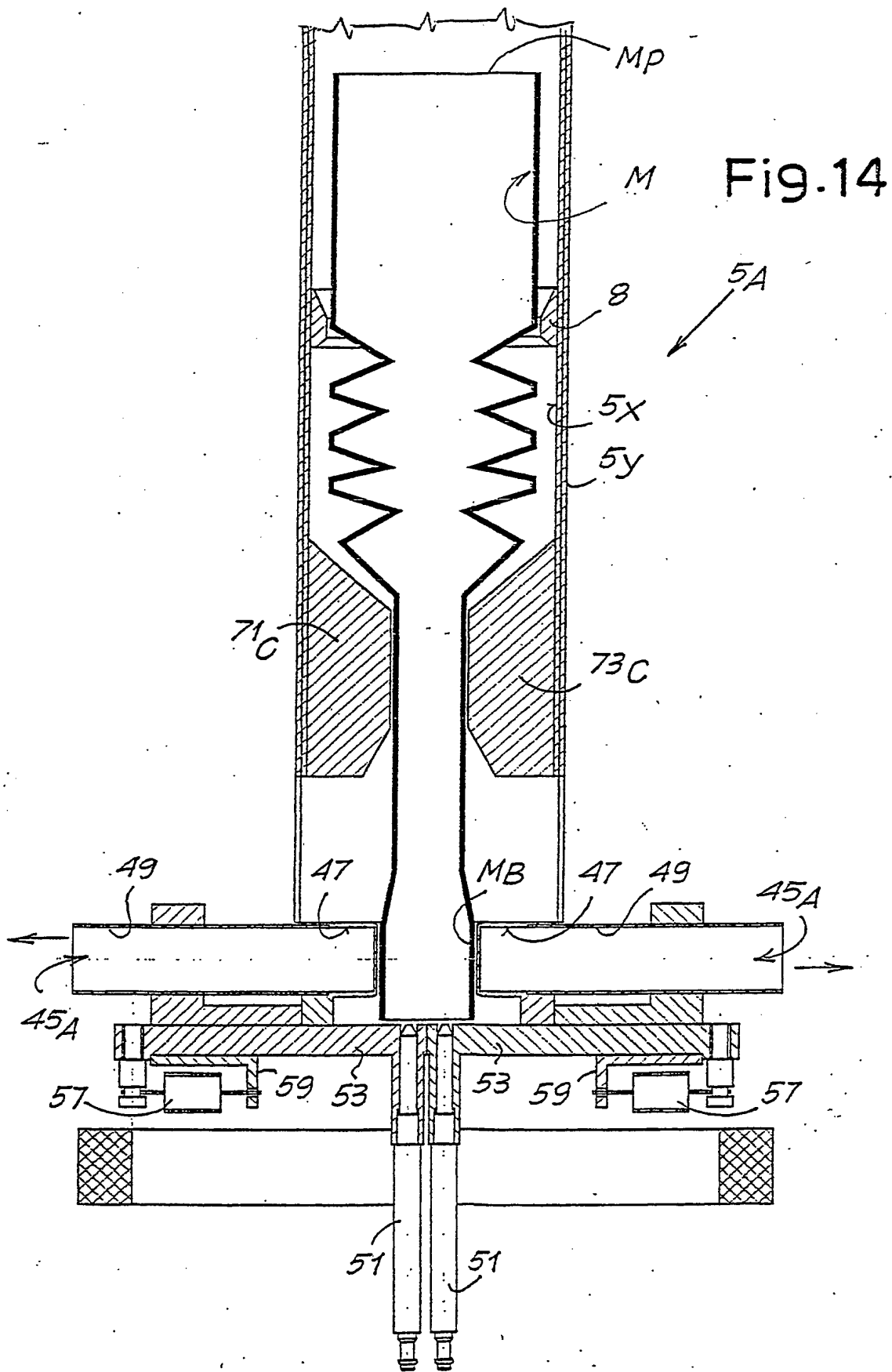
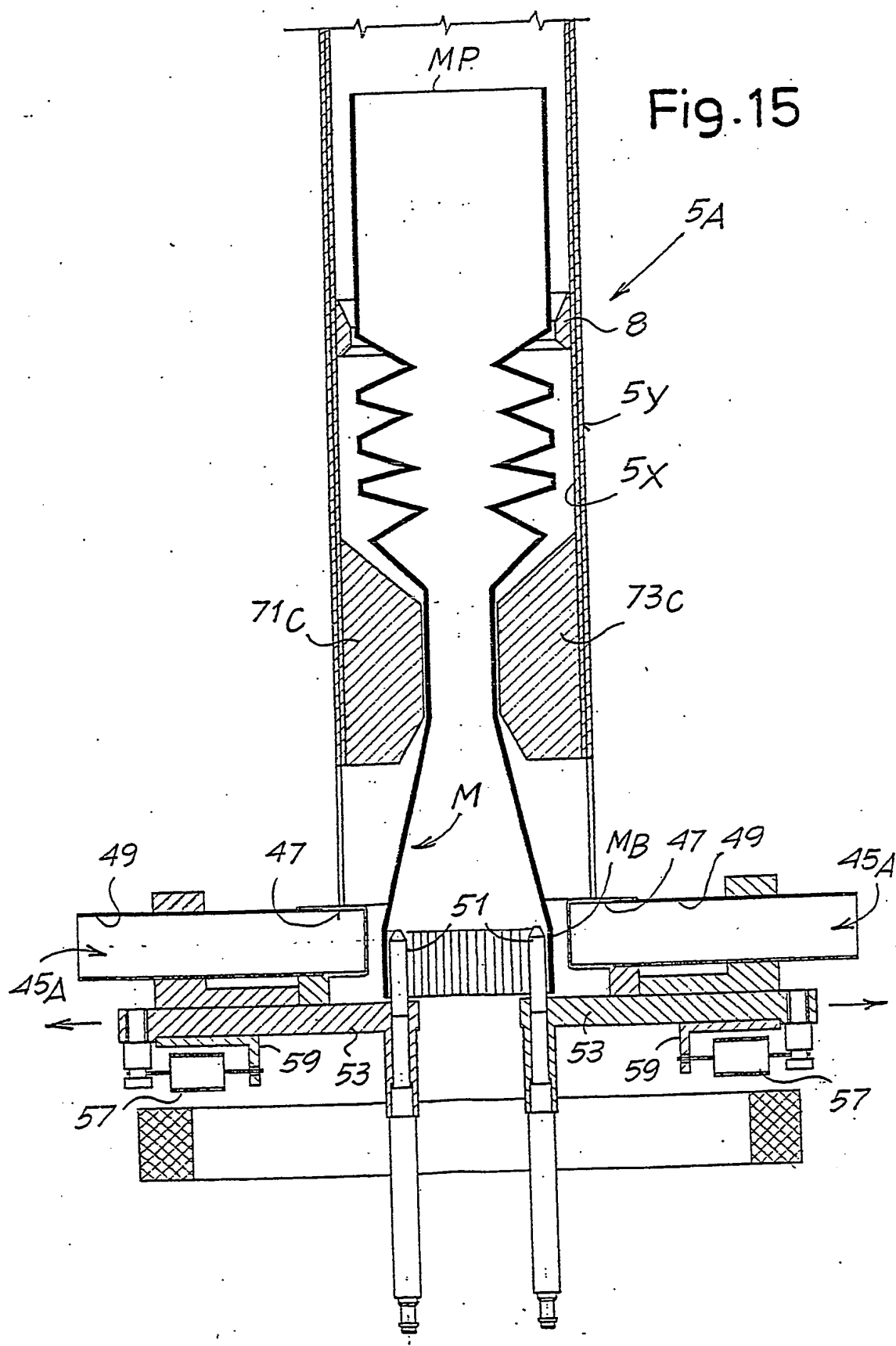


Fig.13







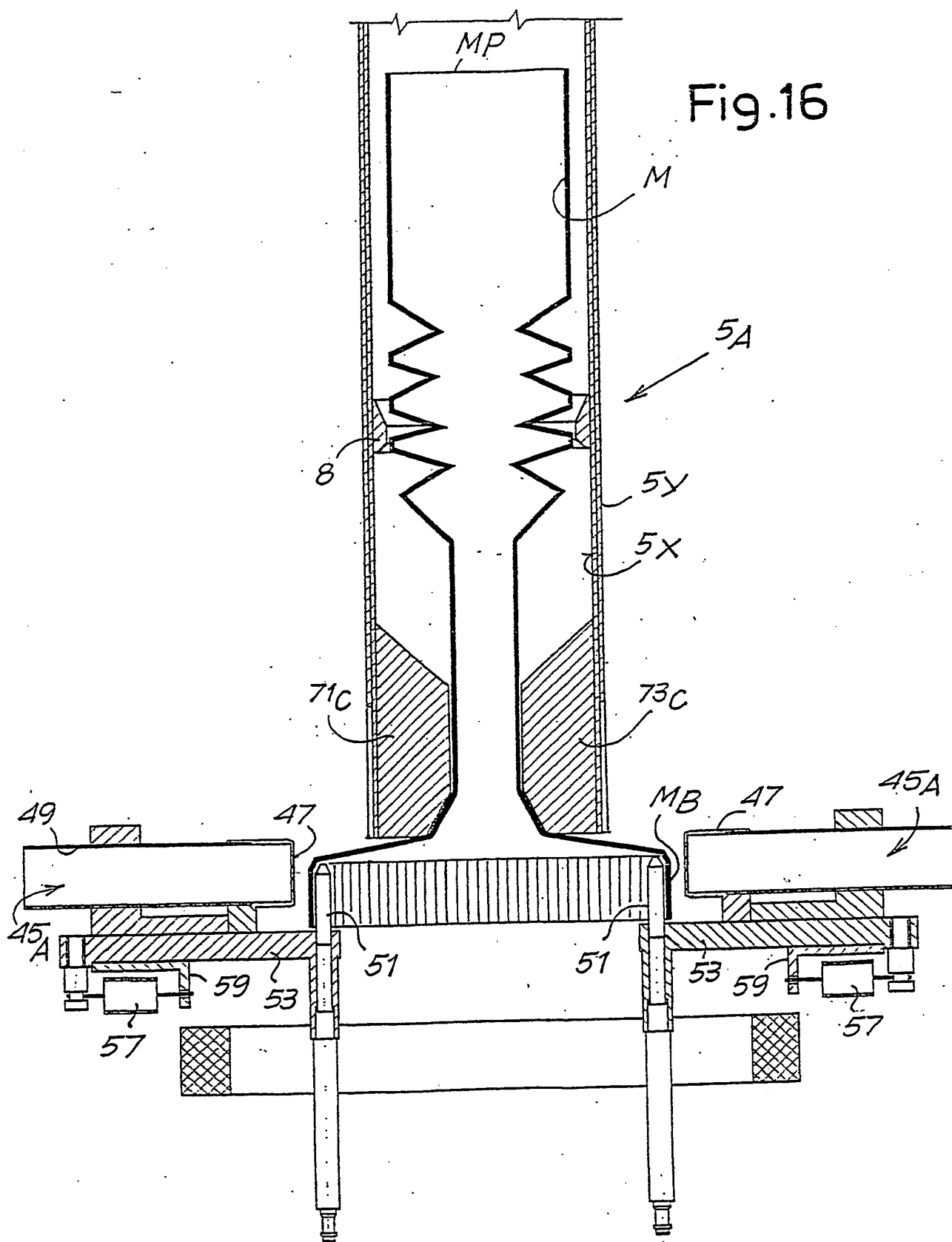


Fig.17

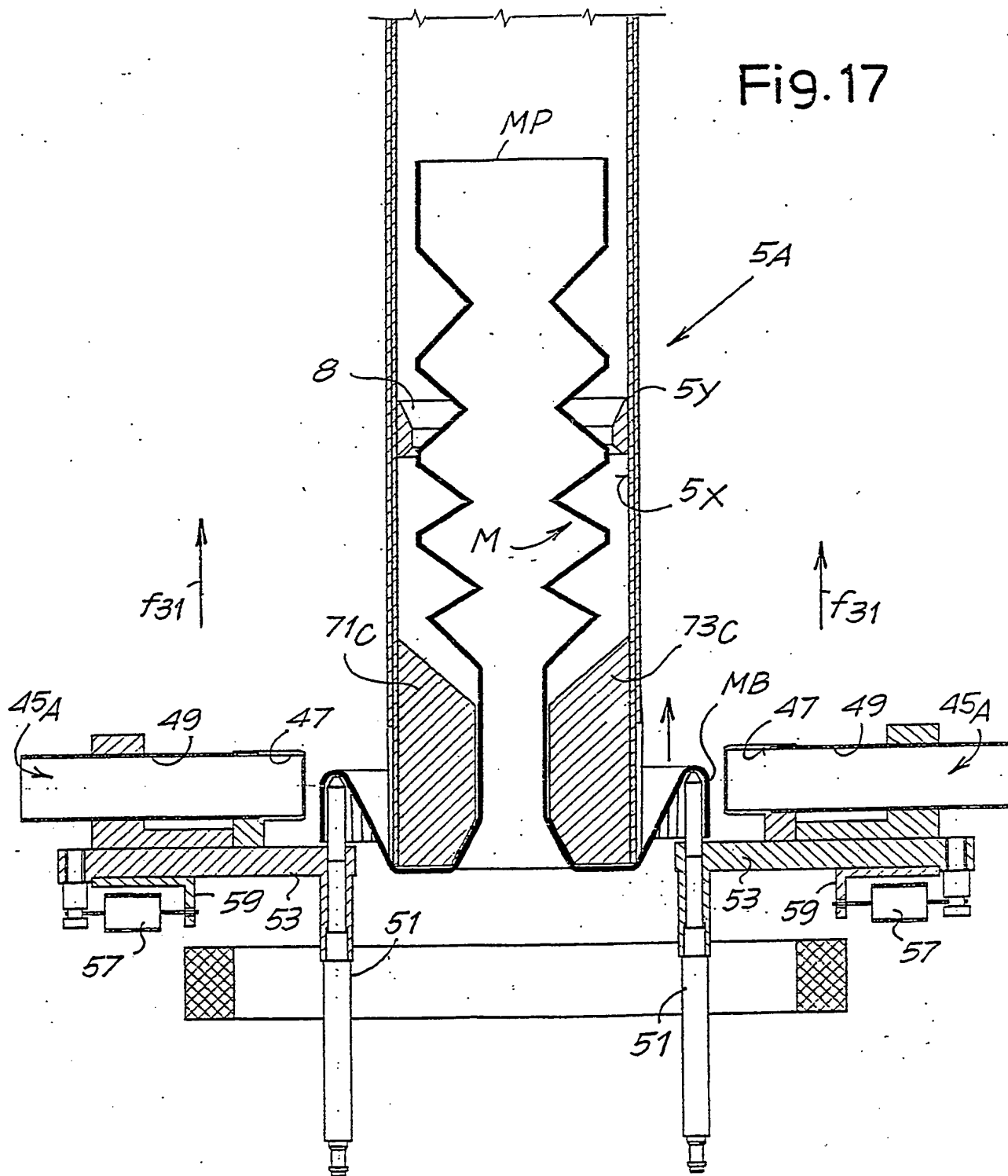
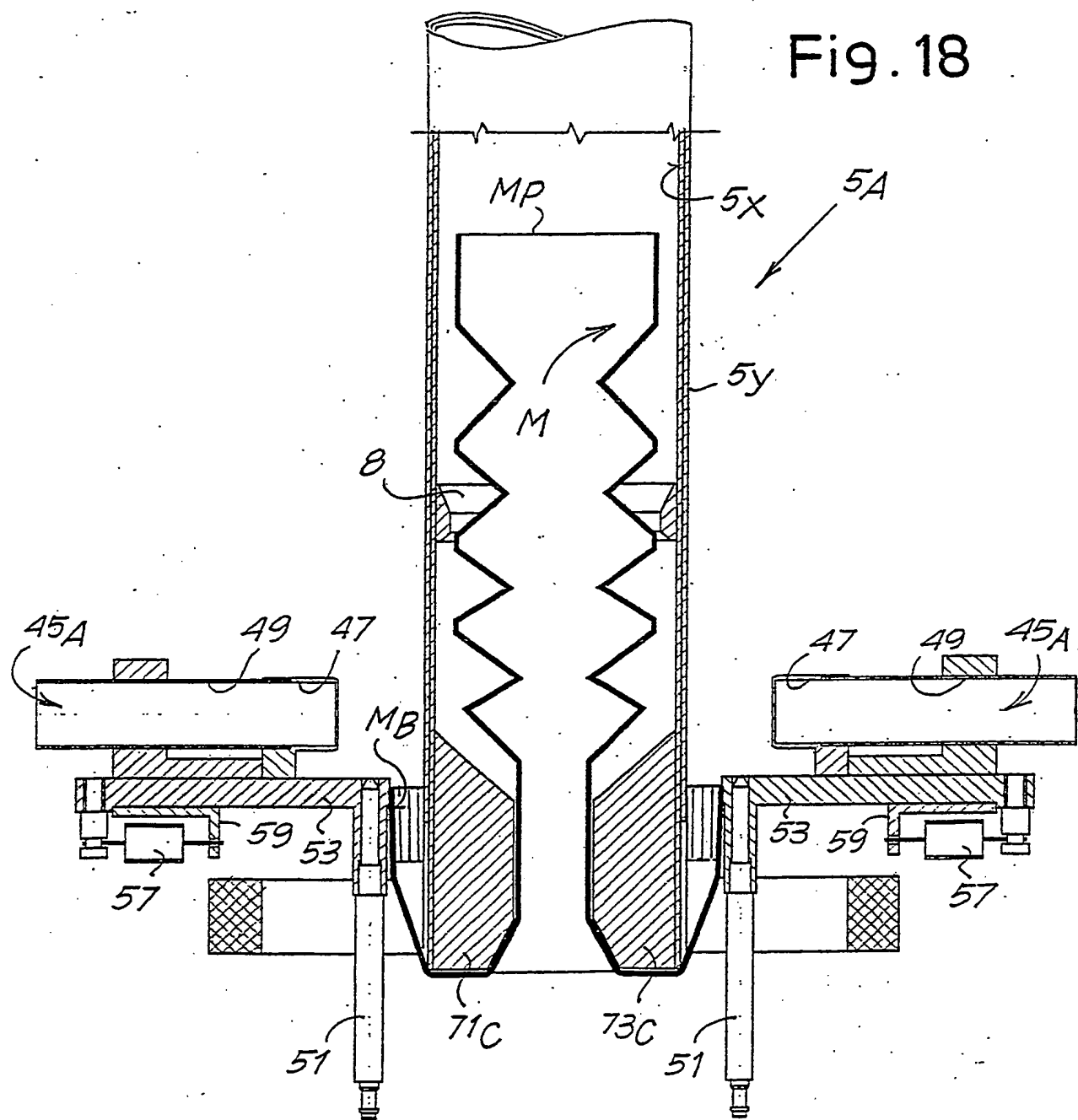
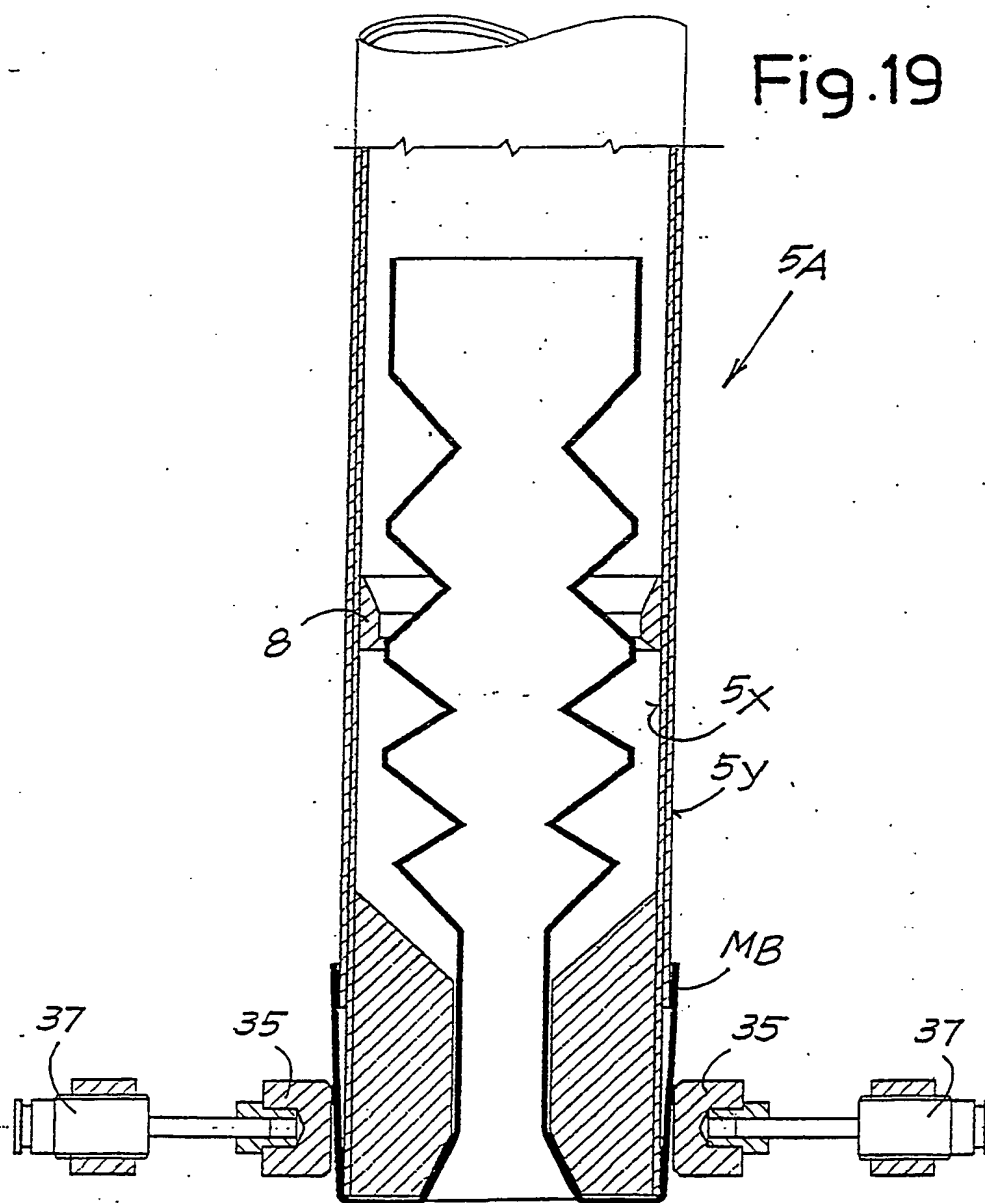


Fig. 18





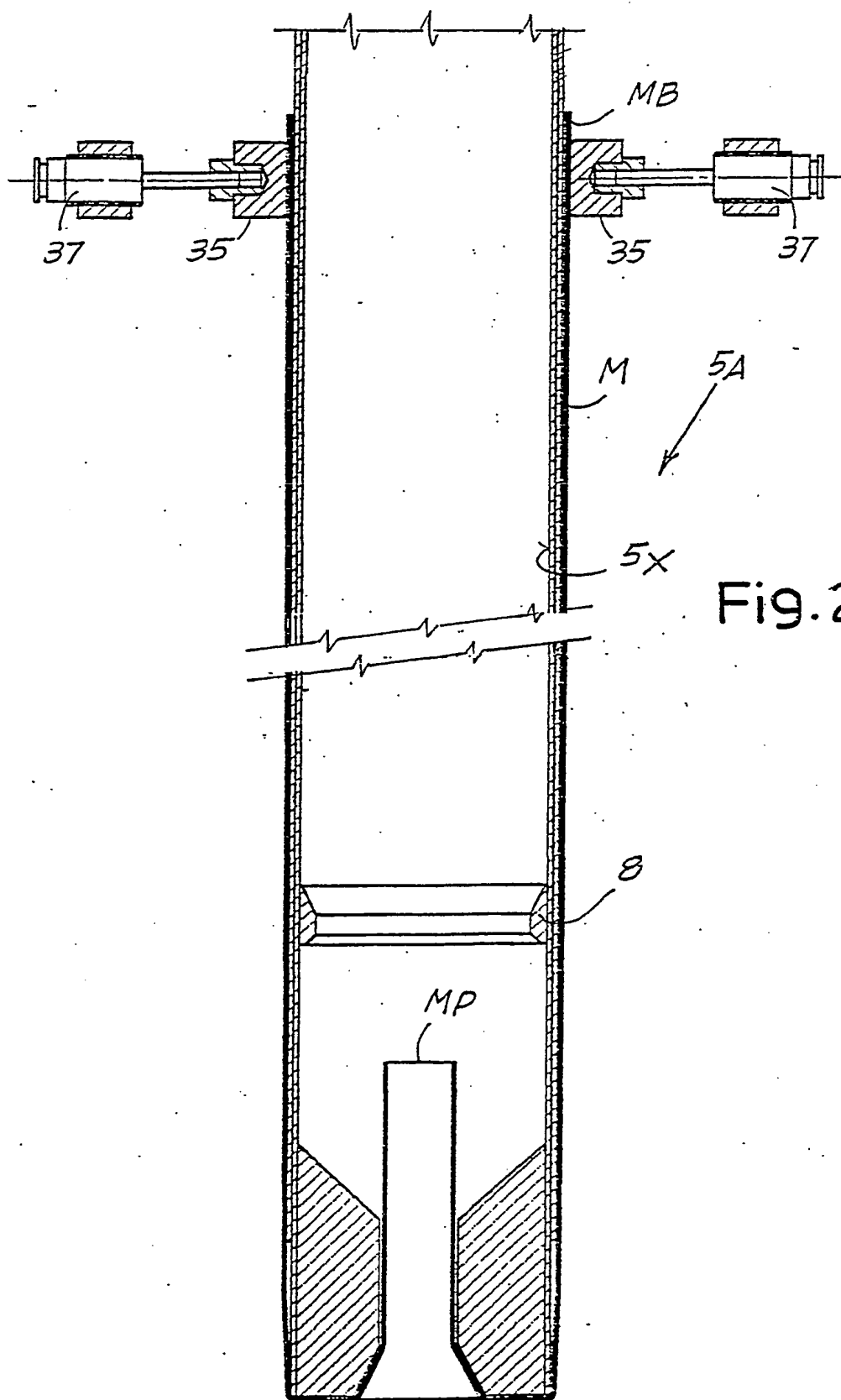
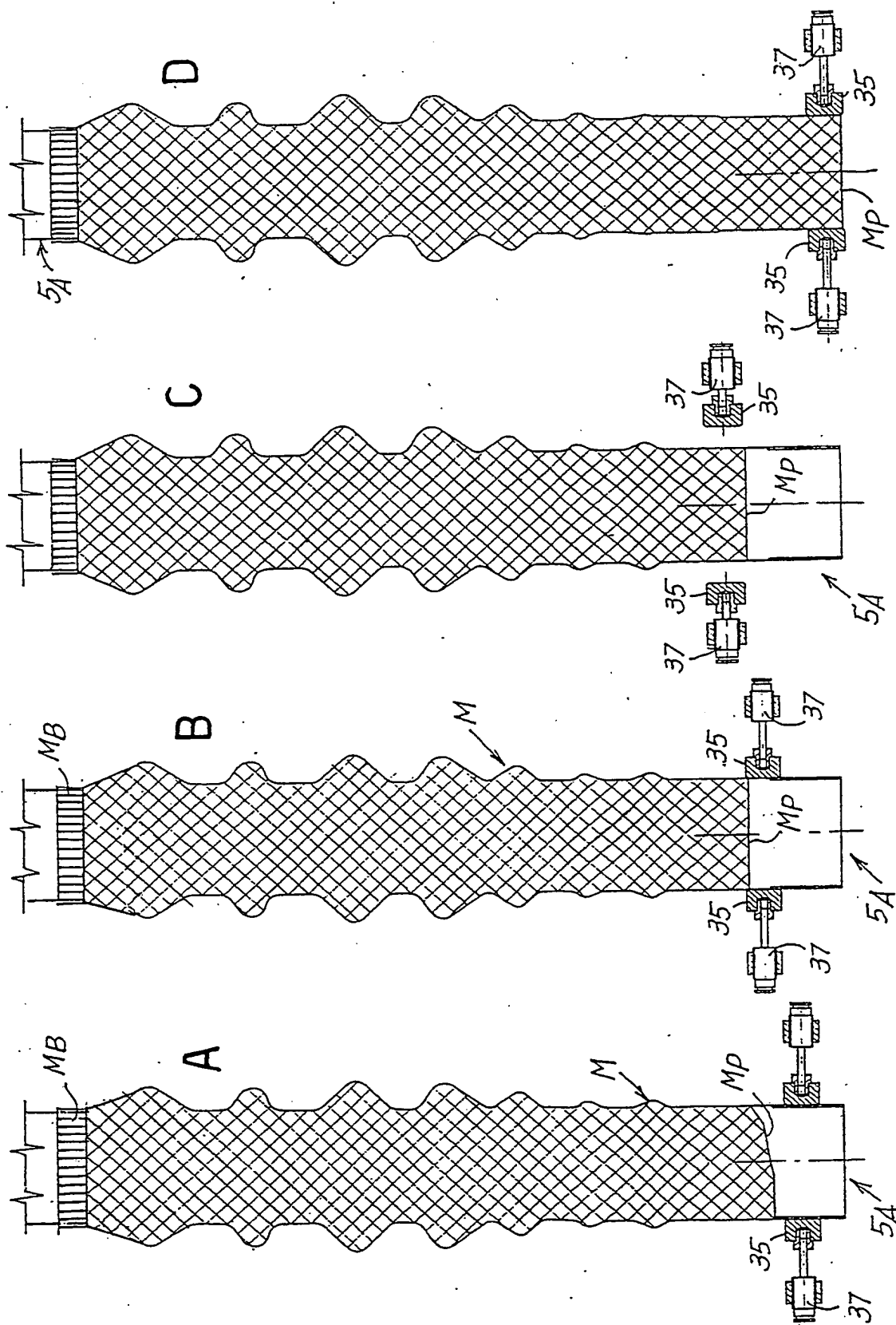
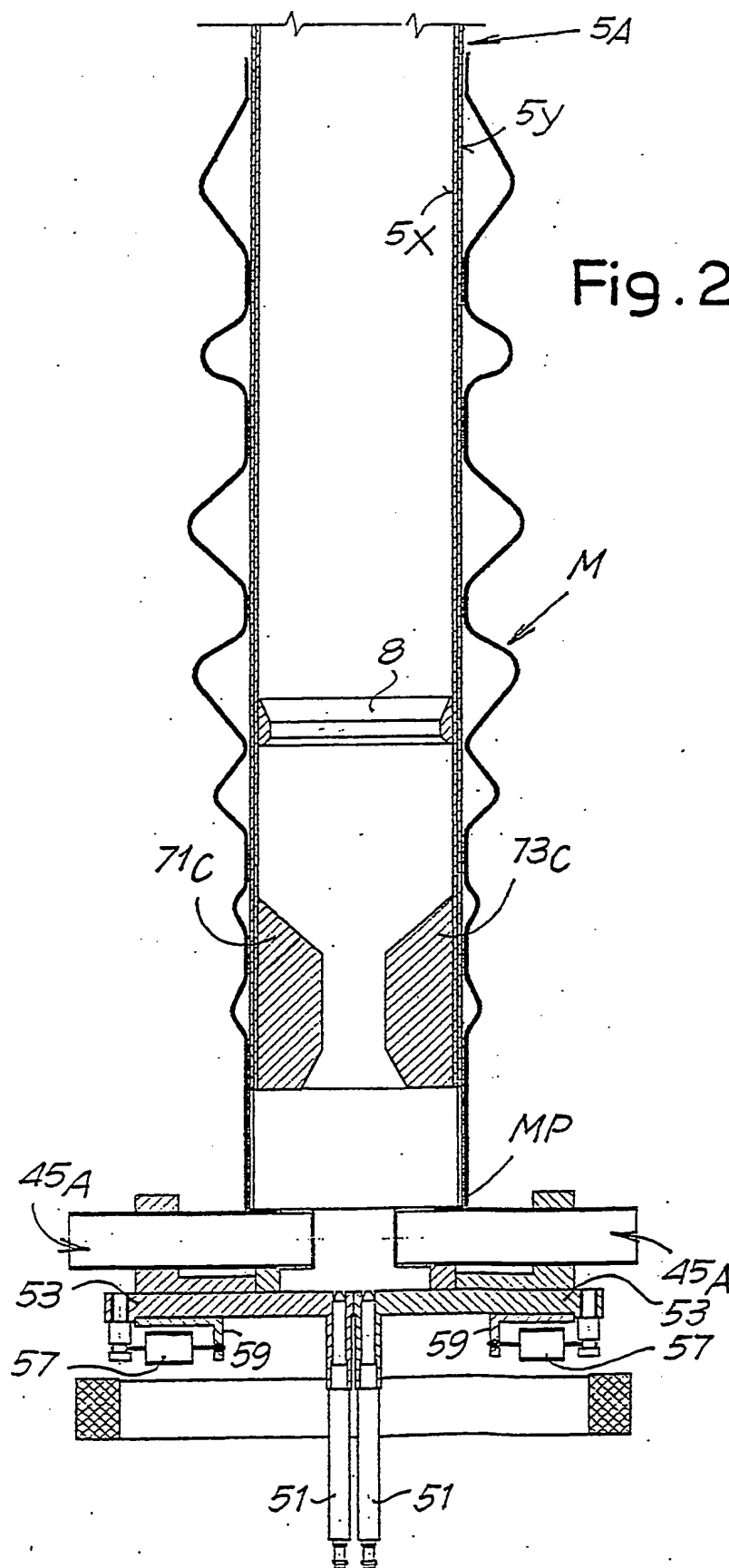
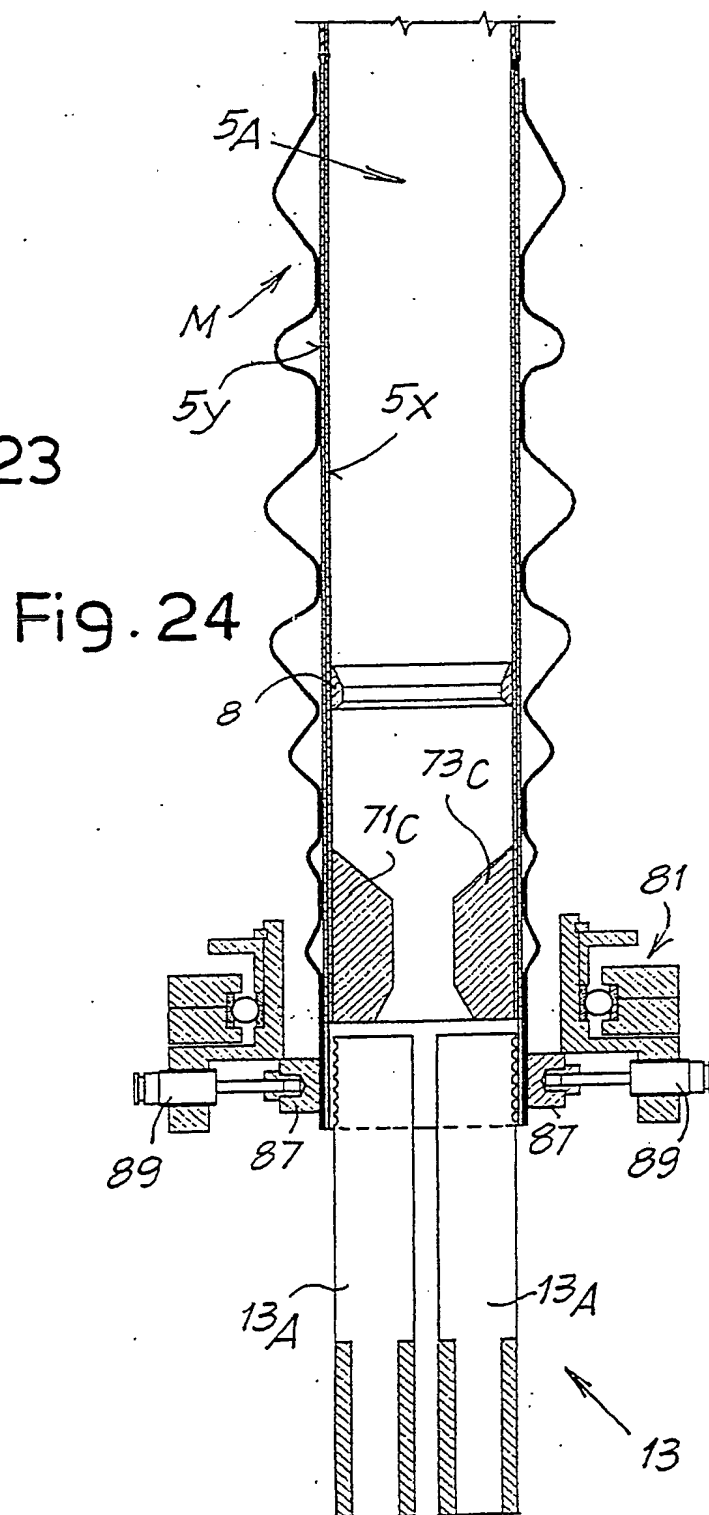
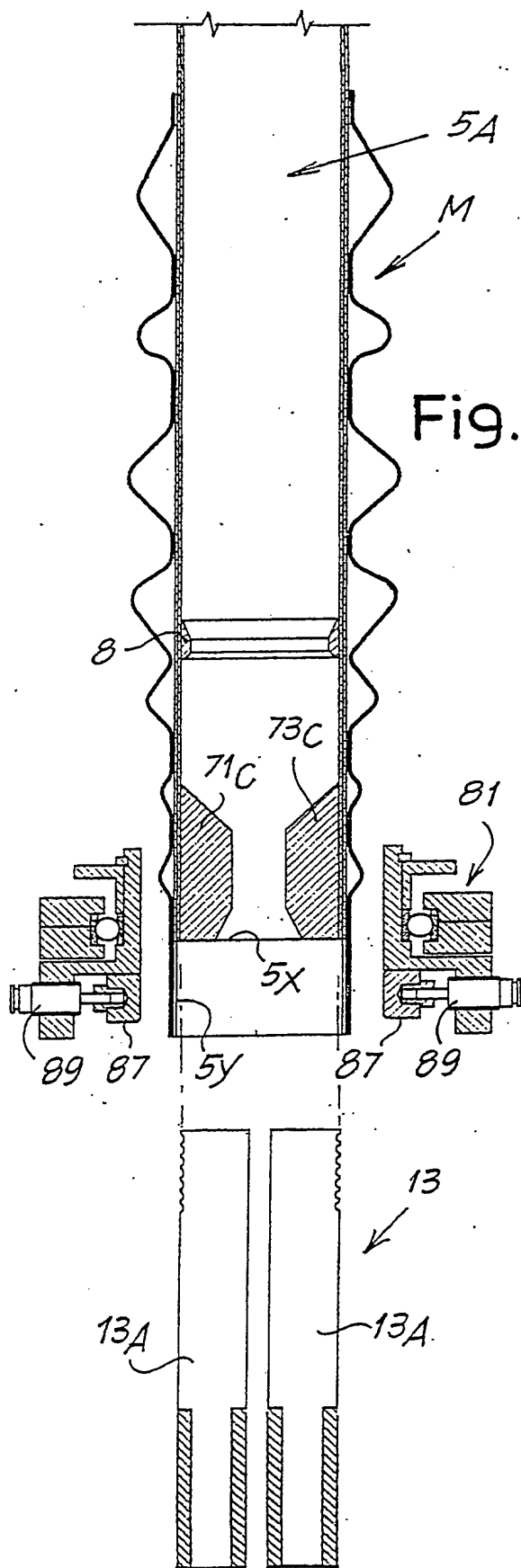


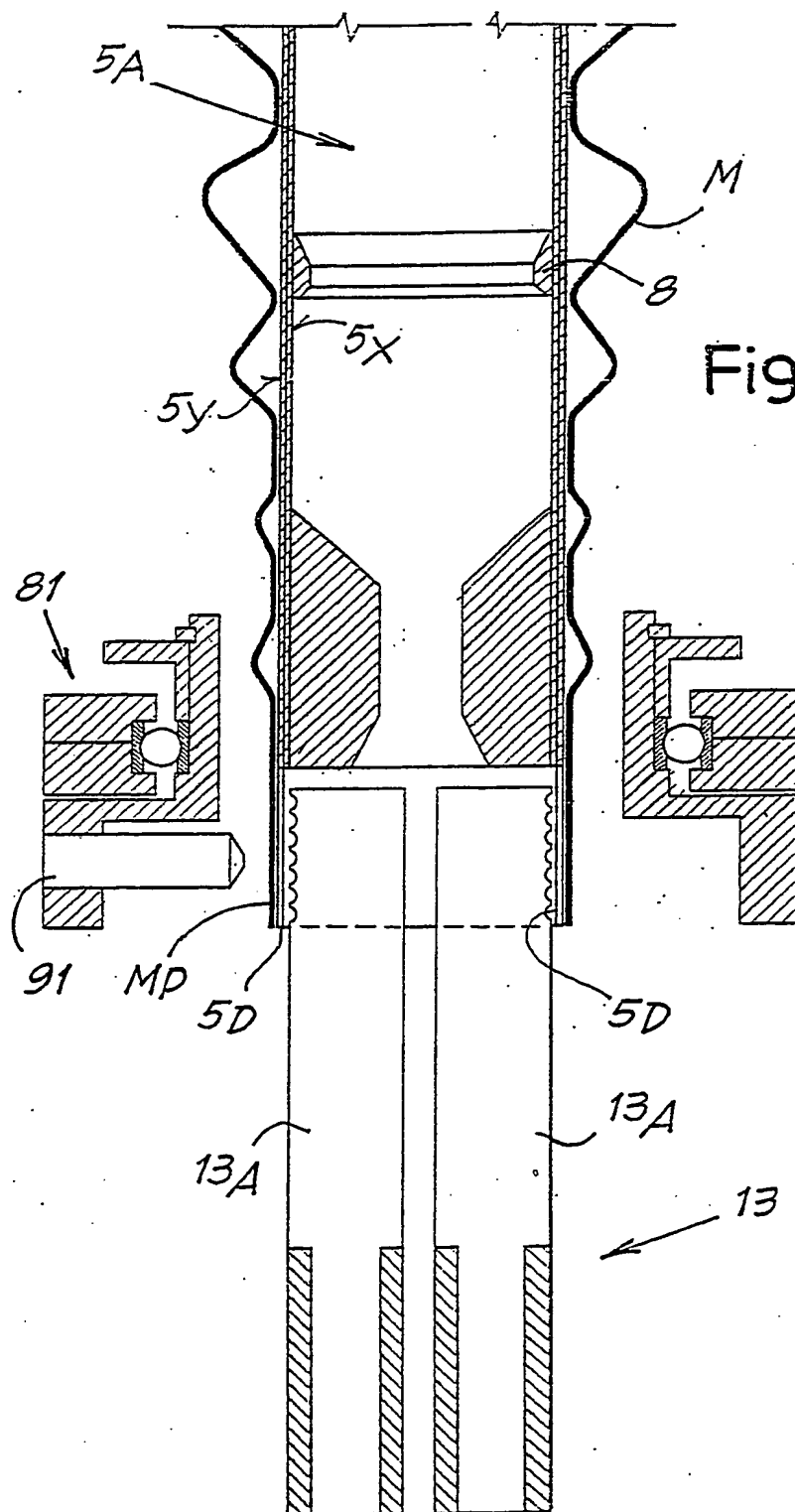
Fig. 20

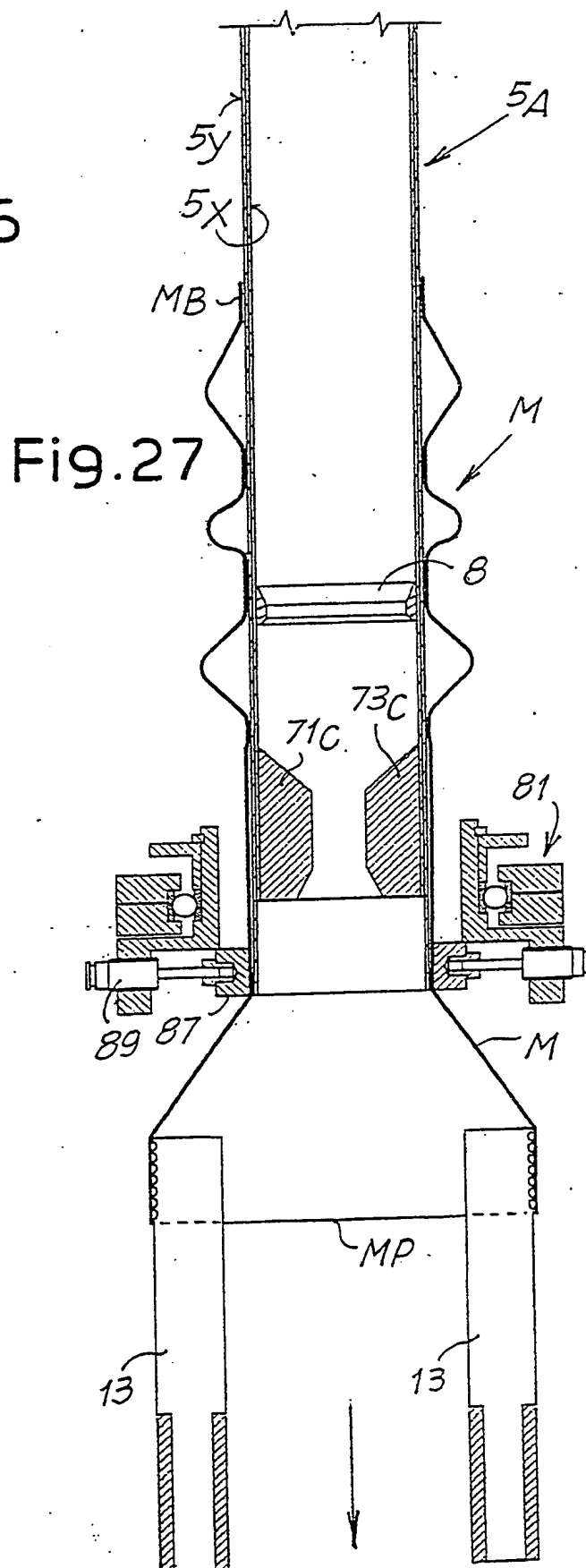
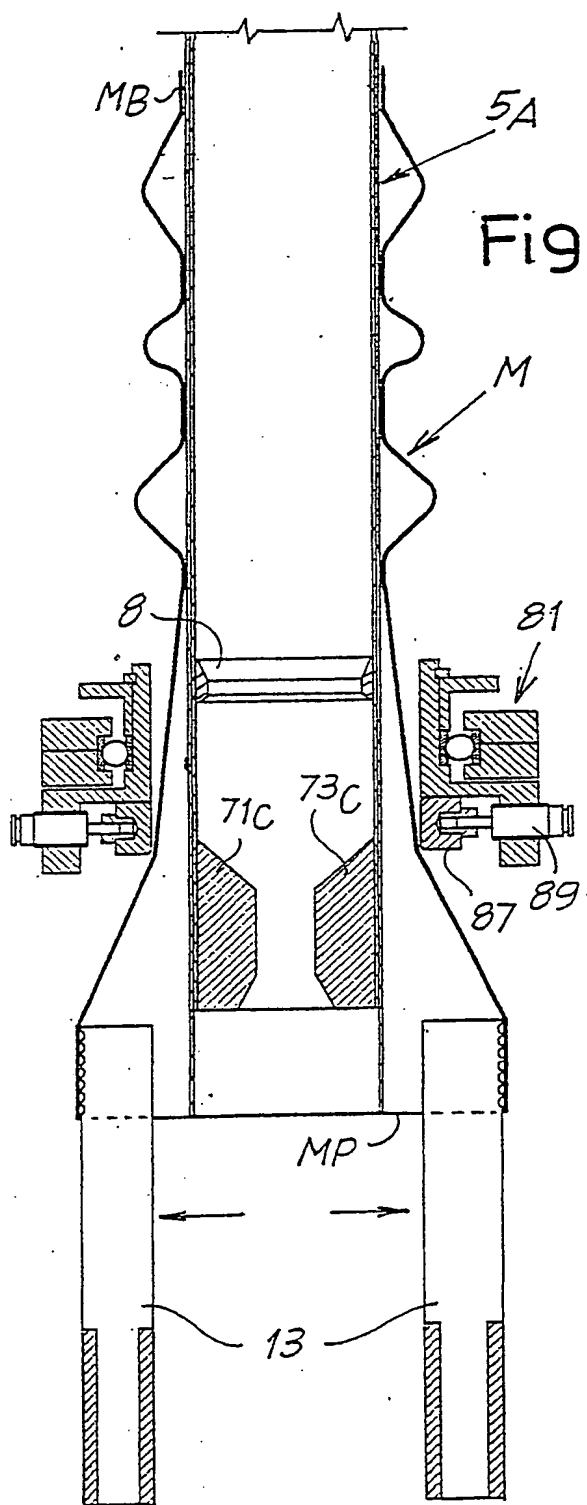
Fig.21











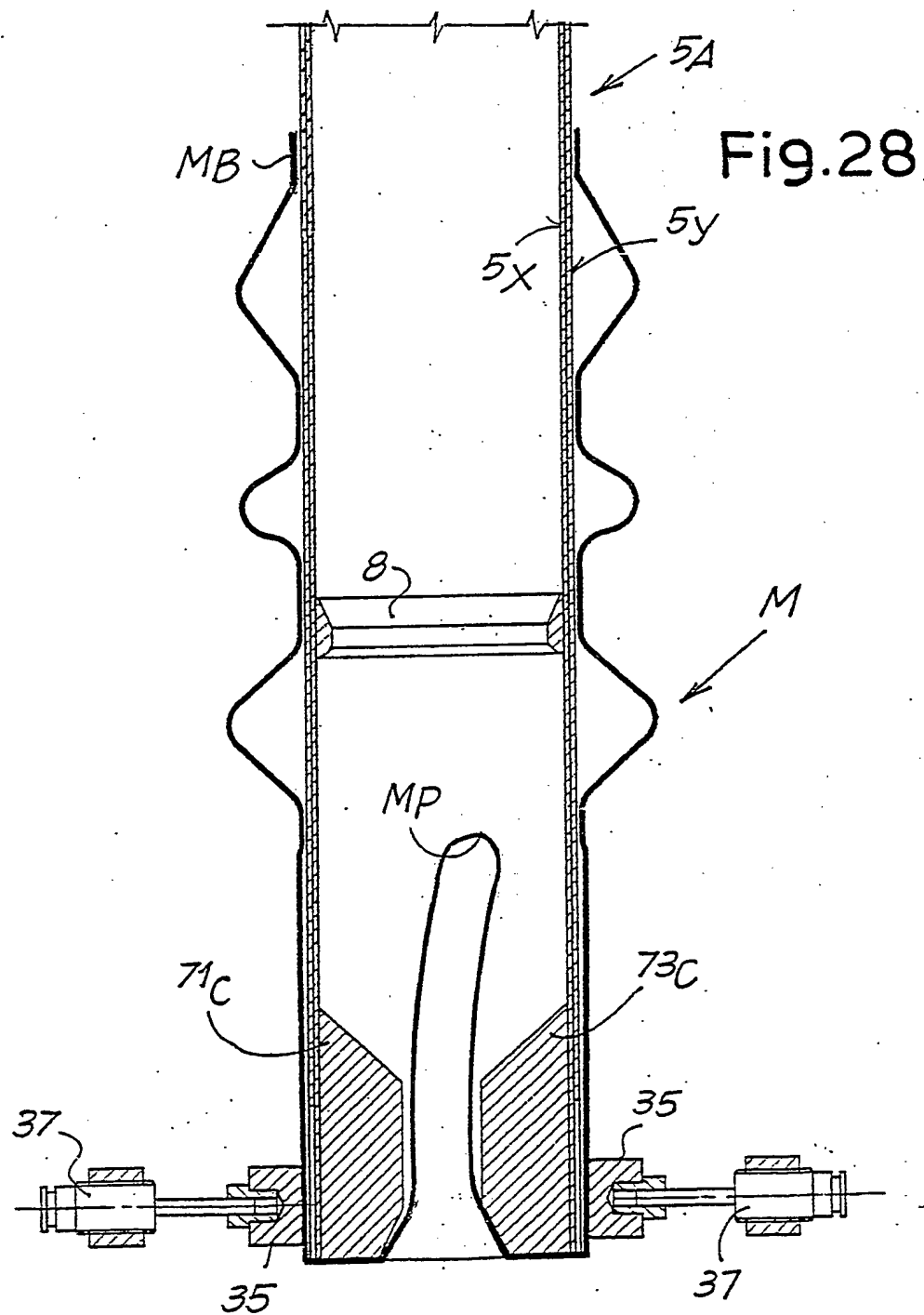
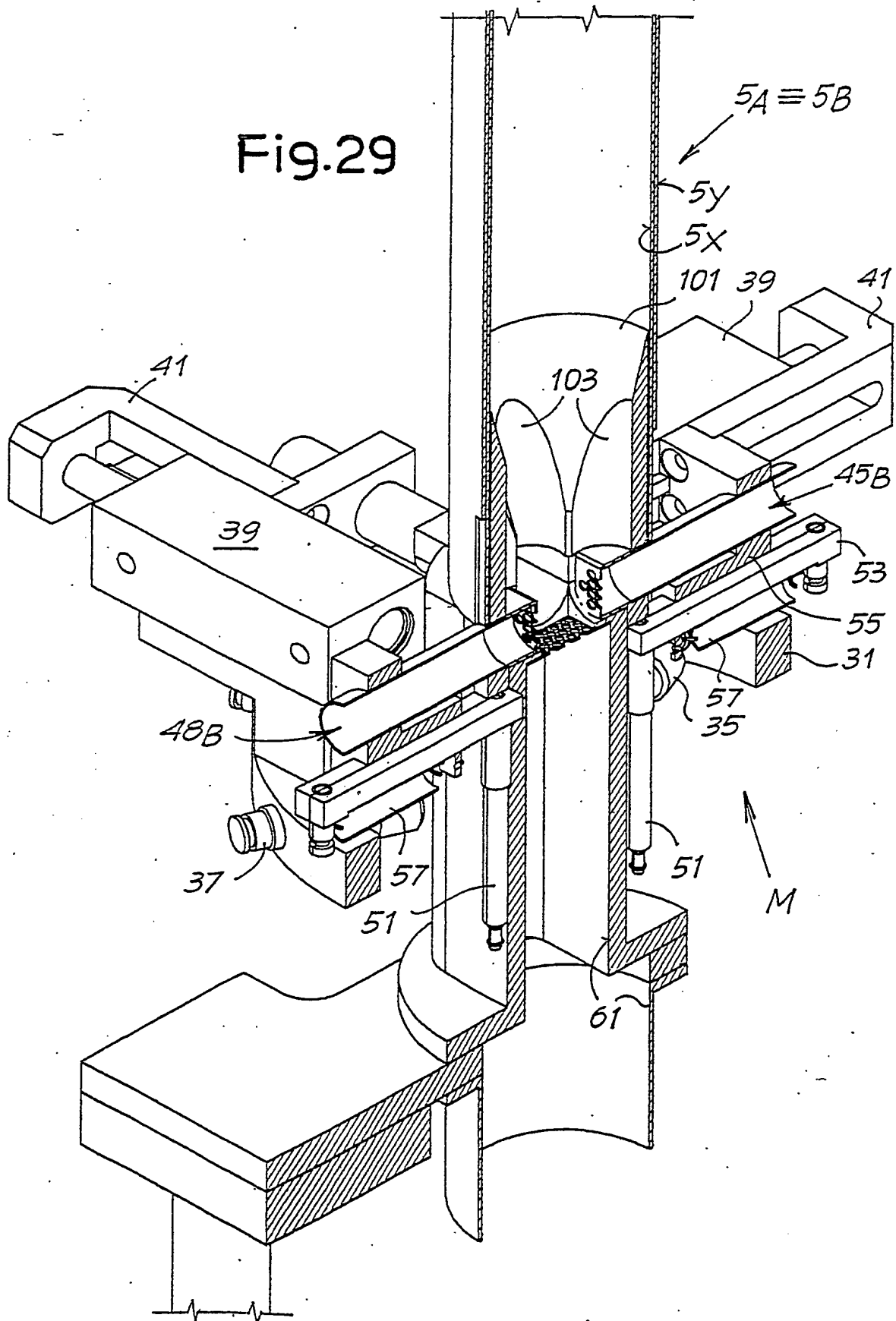
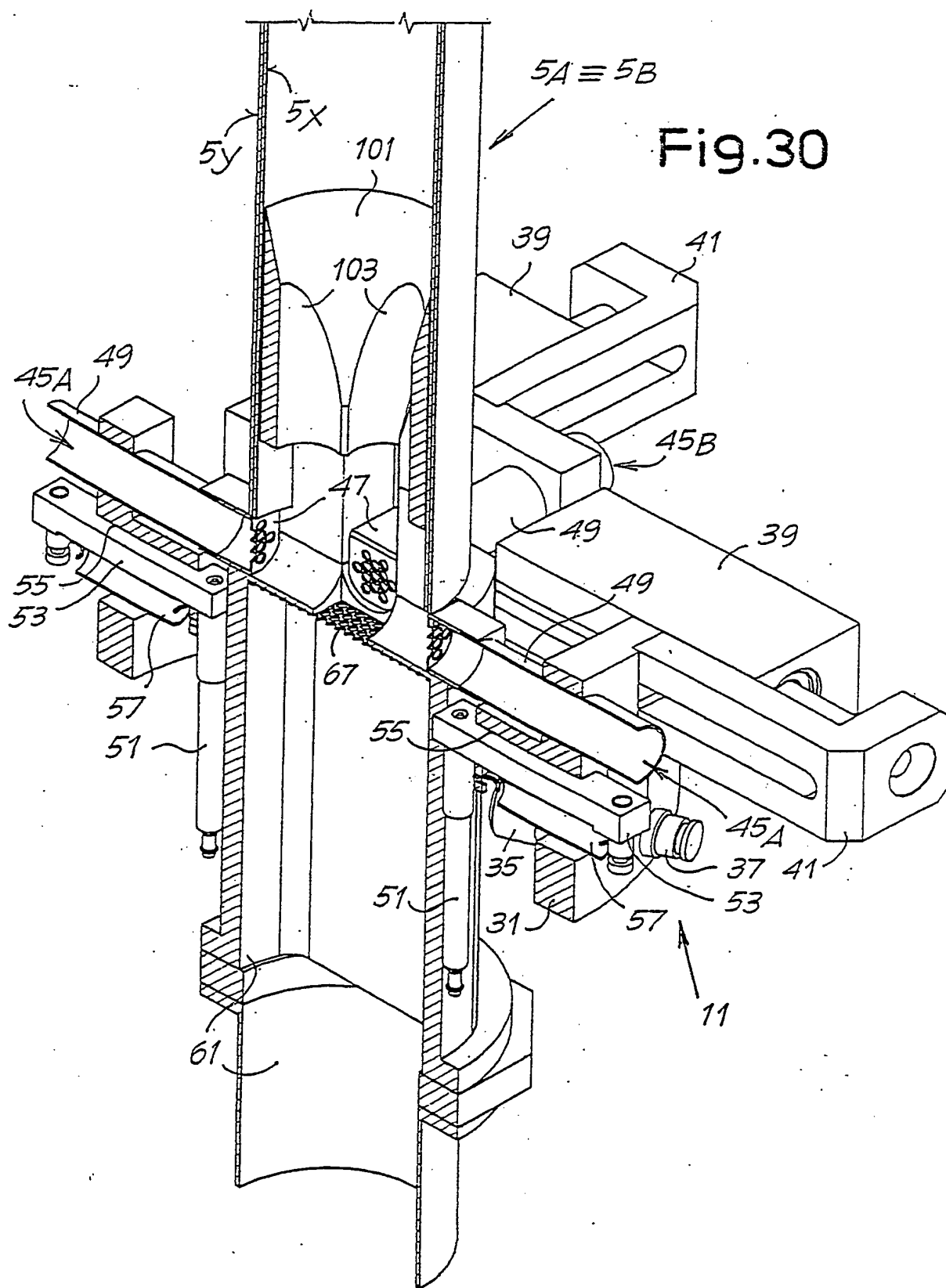


Fig.29





INTERNATIONAL SEARCH REPORT

International Application No

PCT/IT 02/00541

A. CLASSIFICATION OF SUBJECT MATTER
 IPC 7 D04B9/56 D05B23/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 D04B D05B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 0 323 069 A (DETEXOMAT MACHINERY LTD) 5 July 1989 (1989-07-05) column 4, line 51 -column 6, line 28; figures 5,6	1,17
A	WO 00 01869 A (CONTI P ;GOLDEN LADY SPA (IT)) 13 January 2000 (2000-01-13) cited in the application	
A	EP 1 118 700 A (METALWORKING AND FINANCE GROUP) 25 July 2001 (2001-07-25) cited in the application	
A	US 6 158 367 A (JORDAN BOBBY ET AL) 12 December 2000 (2000-12-12)	
A	EP 0 679 746 A (SANGIACOMO SPA) 2 November 1995 (1995-11-02)	

☐ Further documents are listed in the continuation of box C.

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Date of the actual completion of the international search

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Information on patent family members

Interr 1st Application No

PCT/IT 02/00541

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
EP 0323069	A	05-07-1989	DE 3870428 D1 EP 0323069 A2 US 4903621 A US 5014634 A	27-05-1992 05-07-1989 27-02-1990 14-05-1991
WO 0001869	A	13-01-2000	IT FI980164 A1 AU 4647699 A BR 9911916 A CA 2336831 A1 CN 1308694 T EP 1093537 A1 HU 0102665 A2 WO 0001869 A1 JP 2002519534 T NO 20010026 A PL 345411 A1 SI 20536 A SK 182001 A3 TR 200100150 T2 US 6389849 B1	07-01-2000 24-01-2000 27-03-2001 13-01-2000 15-08-2001 25-04-2001 28-11-2001 13-01-2000 02-07-2002 03-01-2001 17-12-2001 31-10-2001 10-07-2001 21-06-2001 21-05-2002
EP 1118700	A	25-07-2001	EP 1118700 A1 AU 3049901 A BR 0107650 A WO 0153581 A1 NO 20023419 A	25-07-2001 31-07-2001 01-10-2002 26-07-2001 16-07-2002
US 6158367	A	12-12-2000	NONE	
EP 0679746	A	02-11-1995	IT BS940042 A1 IT BS940100 A1 AT 169353 T CZ 9501033 A3 DE 69503827 D1 EP 0679746 A2 JP 8060502 A US 5606876 A	26-10-1995 11-03-1996 15-08-1998 15-11-1995 10-09-1998 02-11-1995 05-03-1996 04-03-1997

CASO R. 41526+A
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N° PCT/IT2005/00036
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